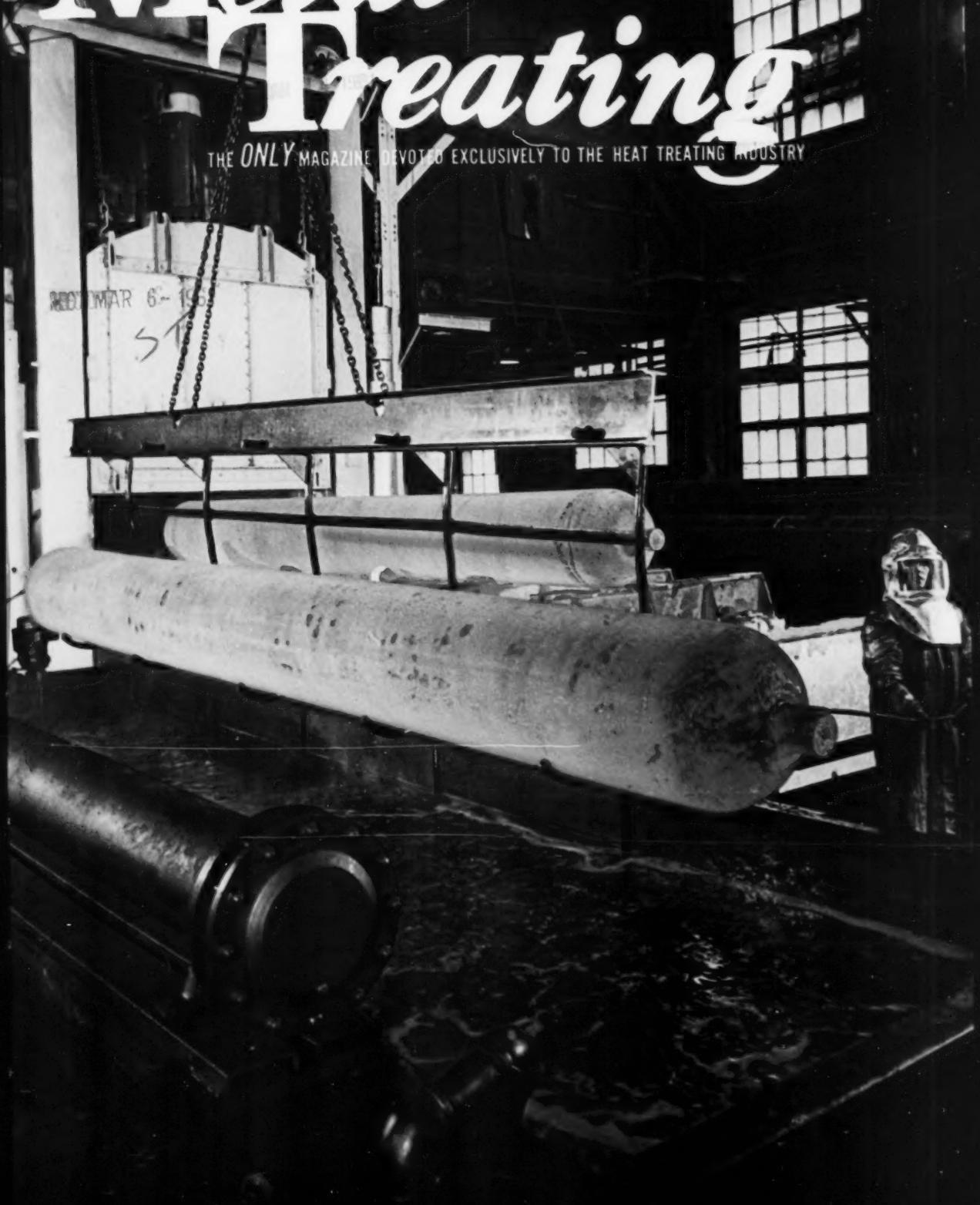


# Metal Treating

THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

FEBRUARY  
MARCH 1961

Vol. 12  
No. 1



Quality . . . the best economy of all

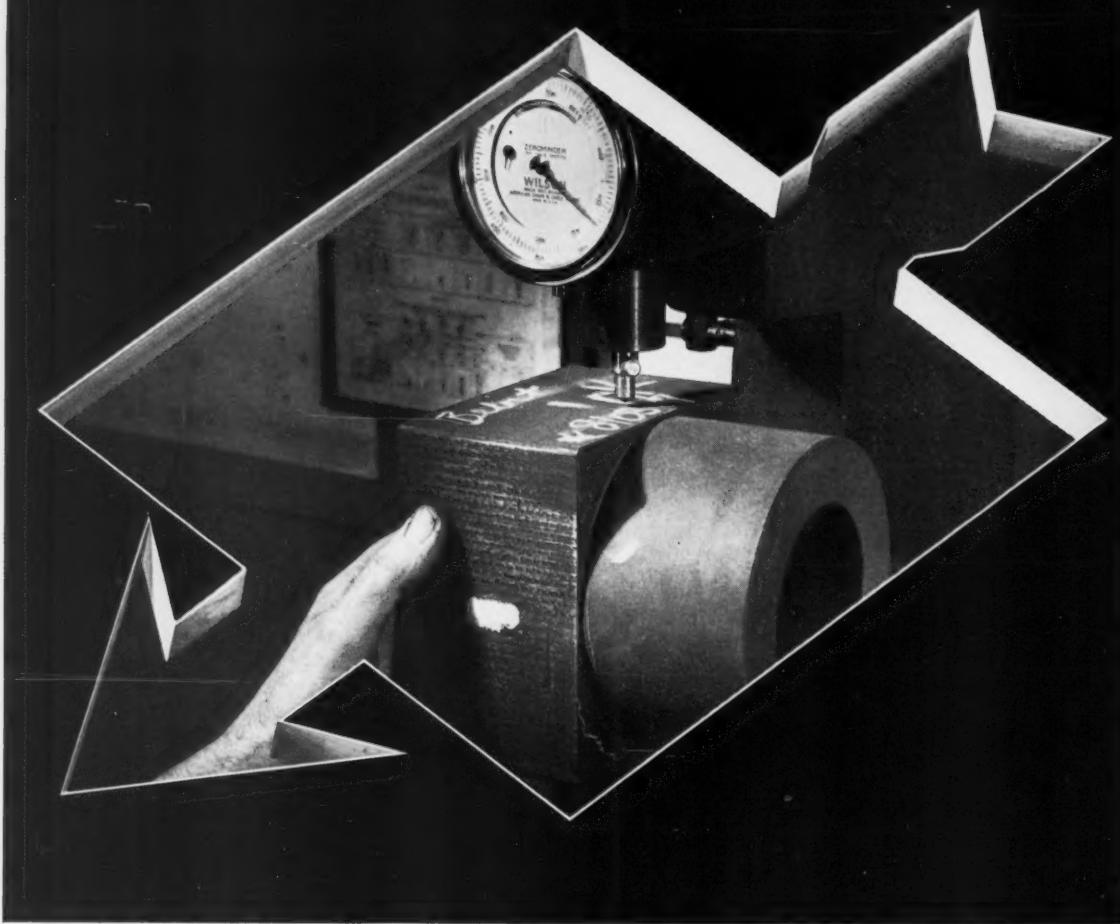


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# Metal Treating

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### About Our Cover

One of Pittsburgh Commercial Heat Treating's outstanding processes is dramatically shown on the cover. Shown is one of the hundreds of 20 ft. by 2 ft. cylinders that are being processed by PCHT. The cylinder has just left the furnace, and is about to be quenched. For more details see the News To Heat Treaters item on page 30.

**DoALL tells how  
Lindberg equipment helps  
produce stainless steel  
gage blocks**

For further information circle No. 76



For the DoALL Company, Des Plaines, Illinois, heat treatment of their Stainless Steel Gage Blocks was a most formidable problem. For lasting accuracy these blocks require extremely hard, wear-resistant surfaces, free from growth or shrinkage, as provided by nitrided stainless steel. Case depth must be controlled accurately and the core maintained at full toughness free of stresses. DoALL found the answer to this problem with a Lindberg Gas Fired Vertical Cyclone Tempering Furnace with a Nitriding Retort.

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## How would you anneal these 5 types of alloy wire?

The various types of alloy wire in this photograph are manufactured for specialized applications by the Riverside-Alloy Metal Division, H. K. Porter Company, Inc. They range from stainless steel, for aircraft industry use, to monel metal and an iron-nickel-cobalt alloy with thermal expansion characteristics suitable for sealing to hard glasses. Annealing temperatures range from 1450 to 2150 F, close control being necessary to maintain wire quality, measured by elongation, grain structure and tensile strength. The wire is annealed continuously—normally in a disassociated ammonia atmosphere.

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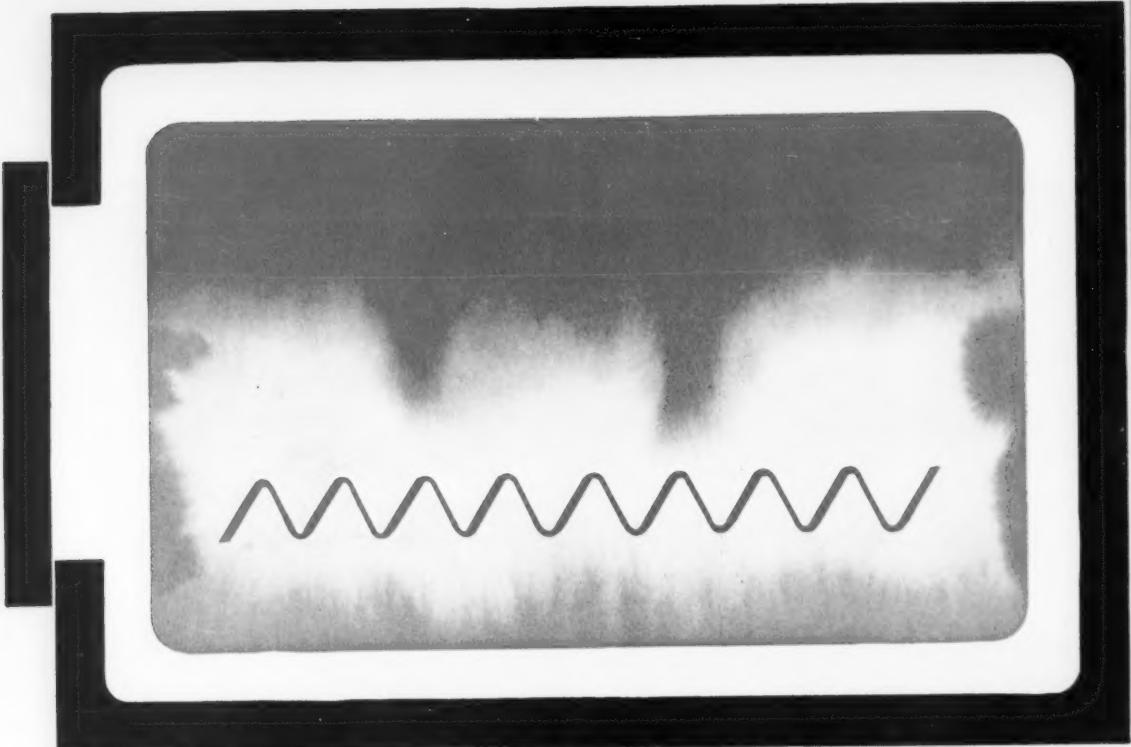
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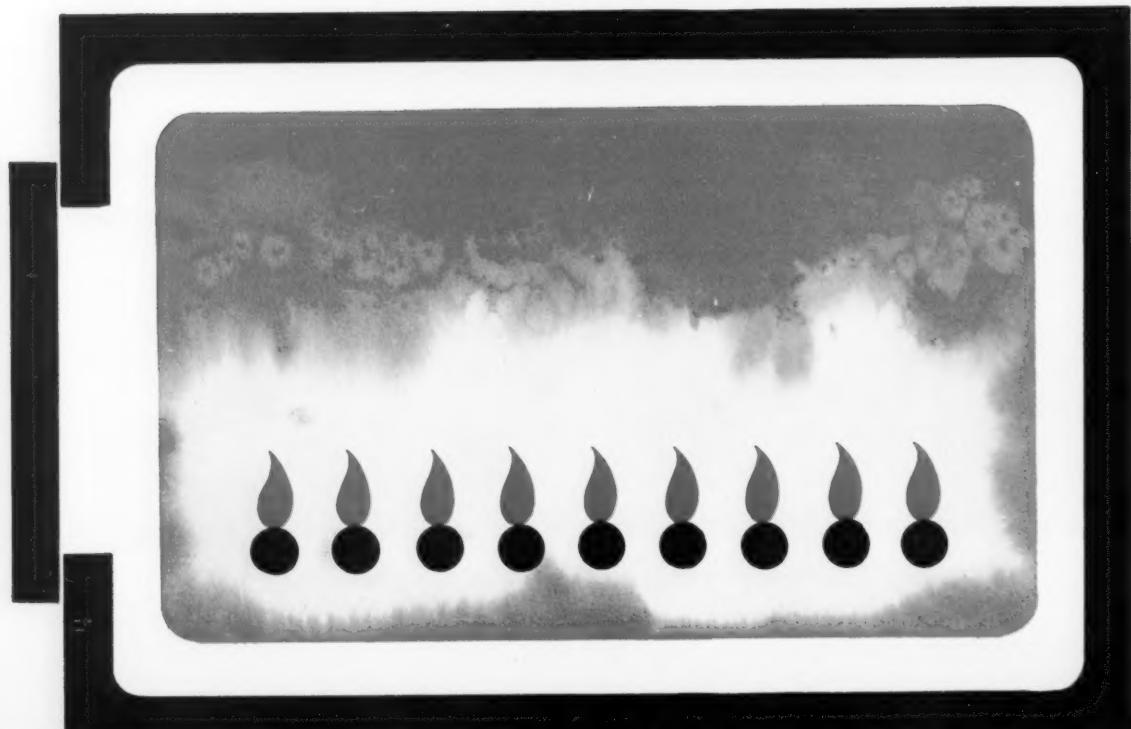
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# Heat Treatment Characteristics

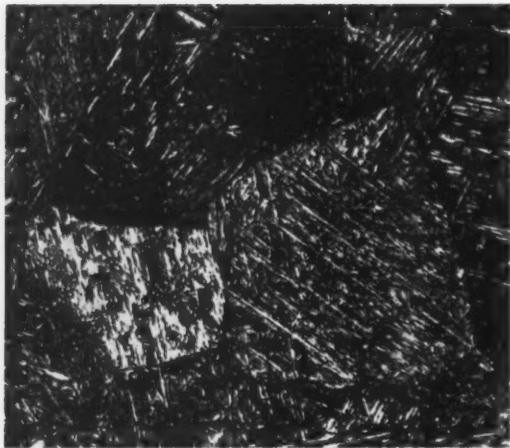


FIG. 1. Magnification 150 x. Etch: potassium bichromate followed by ferric chloride. Water quenched from 800 C. Fine acicular eutectic structure. The grain boundaries of the previous  $\beta$  phase are clearly delineated.

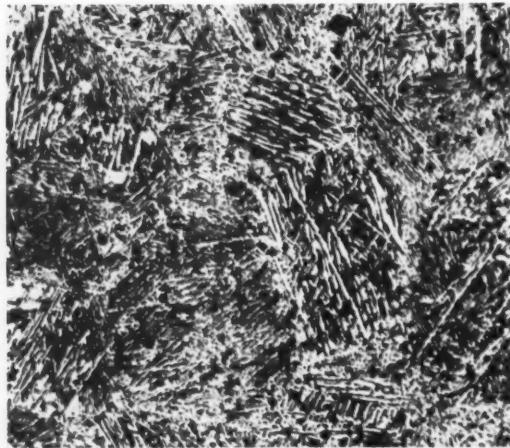


FIG. 2. Magnification 150 x. Etch: potassium bichromate followed by ferric chloride. After the water quench from 800 C. reheated to 500 C. for two hours. Coarsening of the acicular structure and the preferential precipitation of the  $\beta$  phase (white) at previous grain boundaries can be observed.

A. TAUB AND I. HAAS  
Israel Institute of Metals  
The Technion — Israel Institute of Technology

*A cast aluminum bronze alloy was subjected to two basically different thermal treatment processes. The two processes yielded, in the respective microstructures, basically different morphological features. It was found that, in spite of the differences, the peak mechanical properties of the samples were identical, if the final treatment temperature were only slightly above the eutectic temperature of the alloy. At identical mechanical properties, no impairment in chemical resistance was observed in either treatment of the alloy.*

FABRICATED ALUMINUM BRONZE ALLOYS have the advantage of well established commercial heat treatment processes available to enhance their properties for various engineering uses. However, the same alloys employed for castings are treated for homogenization and grain refinement only. In recent times these alloys are used more frequently in the chemical and other industries for castings. For this reason, investigation of the effect of heat treatment on the mechanical properties of an aluminum bronze in its "as cast" condition, was undertaken.

The analysis of the alloy chosen for the present investigation was Al—10.0%; Fe—4.5%; Sn—0.7%; Zn—0.5%; Pb—0.2% with the balance copper.

Cast hoods belonging to chemical machinery of the above alloy, were cut into a large number of Izod impact test specimens. These served for all the experiments in heat treatment, microscopic analysis\* and mechanical tests. The samples, after receiving homogenization at 850 C. for one hour, were subjected to two series of basically different thermal treatments—A and B—represented graphically in charts 1 and 2 respectively. For each step in the thermal treatment and for the subsequent mechanical tests, a group of 30 Izod specimens were employed. This was done in view

\*All the photomicrographs presented in this article were obtained by etching the metallographically polished samples with potassium bichromate followed by ferric chloride reagents.

# of a Cast Aluminum Bronze Alloy

of the fact that the castings were not mechanically treated in any forging or other operation. The influence of minute casting defects upon the test results were largely eliminated by the great number of samples employed.

In treatment A, samples were heated to 800°C. into the  $\beta$  region, according to the equilibrium diagram of the alloy and subsequently water quenched. This step is verified microscopically in figure 1, which shows the previous  $\beta$  grain boundaries, while in the enclosed areas the very fine eutectic product is visible. The acicular nature of the latter is due to the high cooling rate employed. After this quench, specimens were reheated to a temperature between 400°C. and 750°C. with 50°C. intervals and held isothermally for two hours. They were then allowed to cool, in air, to room temperature.

In treatment B, after reheating the samples to 800°C., they were allowed to furnace cool to a predetermined temperature, between 750°C. and 450°C., with 50°C. intervals. After reaching the required temperature they were water quenched to room temperature.

The samples which underwent the two types of thermal treatment processes, were subjected to microscopical examinations. It was revealed that basic morphological differences exist between the products of treatment A and B. In treatment A, the acicular

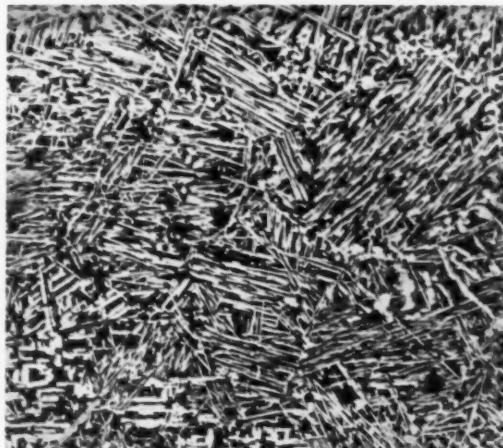
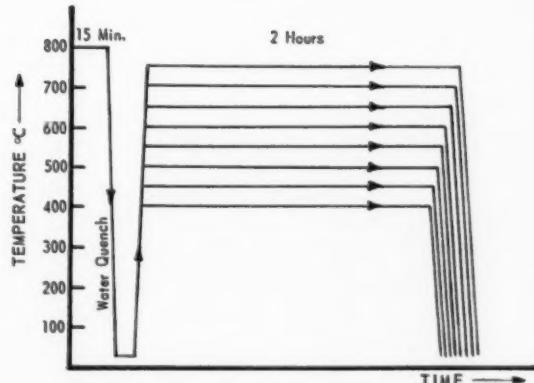


FIG. 3. Magnification 150 x. Etch: potassium bichromate followed by ferric chloride. After the water quench from 800°C., reheated to 600°C. for two hours. Substantial coarsening of the acicular eutectic structure occurred. (— white and — black). The mechanical properties of this structure are identical to those represented by figure 6.

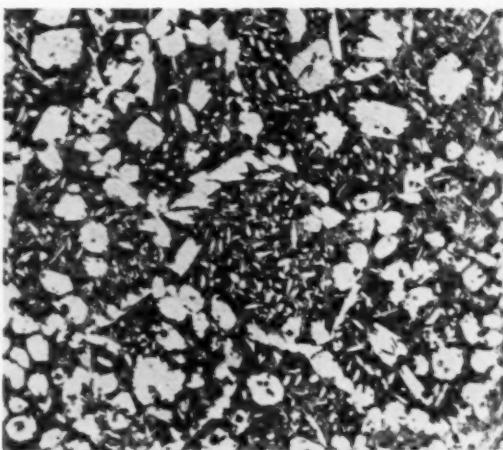


FIG. 4. Magnification 150 x. Etch: potassium bichromate followed by ferric chloride. After the water quench from 800°C., reheated to 700°C. for two hours. Equiaxed  $\alpha$  grains (white) in previous  $\beta$  phase grain boundaries, embedded in a  $\beta$  —  $\beta$  (black) eutectic.

**continued**  
**on the next page**



FIG. 5. Magnification 150 x. Etch: potassium bichromate followed by ferric chloride. Furnace cooled from 800 C. to 700 C. and water quenched. Equiaxed grains (white) precipitated mainly in previous  $\beta$  phase grain boundaries, embedded in a fine acicular eutectic matrix.

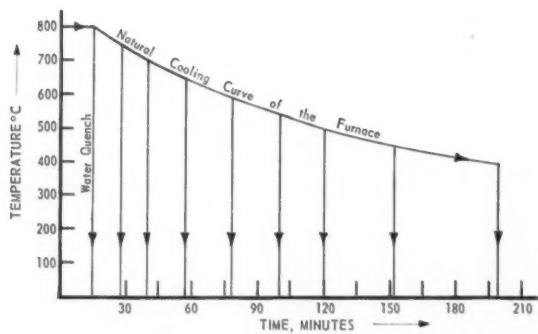


CHART 2. Thermal Treatment "B." Specimens after heating to the  $\beta$  region at 800 C. were allowed to furnace cool to predetermined temperatures, from which they were water quenched to room temperature.

## heat treatment characteristics of cast aluminum

bronze alloy

eutectic structure, devoid of proeutectic precipitation of the  $\delta$  phase, was further treated isothermally. On the other hand, in treatment B, we allowed from the onset, the precipitation of the proeutectic  $\alpha$  phase. In figures 2 and 3, pertaining to treatment A, the coarsening of the fine acicular structure may be observed, as the isothermal treatments were carried out below the eutectic temperature. In figure 4, the precipitation of proeutectic  $\delta$  grains in previous  $\beta$  grain boundaries are visible, as the isothermal temperature in this case, 700 C., was above the eutectic temperature of the alloy—550-570 C.

The samples in treatment B have shown increasing amounts of proeutectic  $\alpha$  grains precipitated in previ-

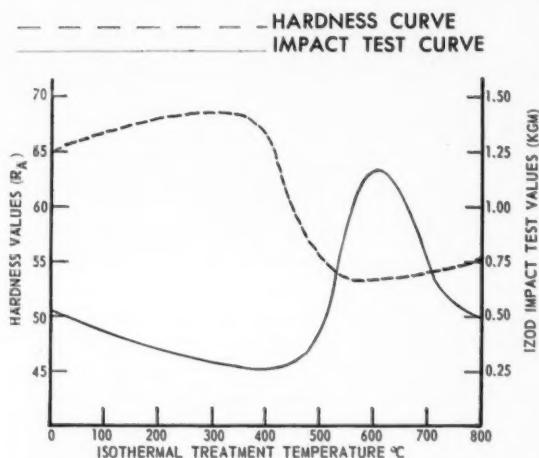


CHART 3. Heat Treatment "A." Hardness and impact test values as a function of the isothermal treatment temperature.

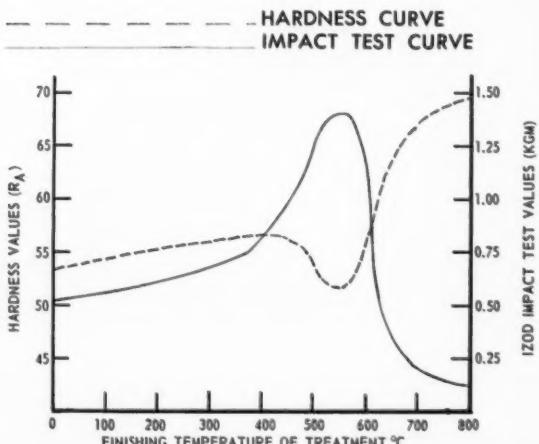


CHART 4. Heat Treatment "B." Hardness and impact test values as a function of the temperature at which the furnace cooling of the alloy was interrupted.

ous grain boundaries. The rest of the structure is an acicular eutectic resulting from the higher than eutectic temperatures from which they were quenched, and from the high cooling rates employed in the quenching operations. This condition is represented in figures 5 and 6. Allowing the samples to furnace-cool to lower than eutectic temperature, structures develop as represented in figure 7, where the eutectic no longer has the abnormal acicular structure.

Having received two series of basically different structures from the microscopic point of view, the samples were subjected to hardness and Izod impact tests. The results of these experiments are illustrated graphically in charts 3 and 4. For each thermal experiment, 90 hardness tests on the Rockwell "A" scale and 30 Izod impact tests were carried out.

Correlating the test results, it becomes evident that the highest impact value is obtained when the final temperature of the heat treatment is only slightly above the eutectic temperature. At such conditions, in both series of heat treatments, a peak on the impact curves is obtained, with a corresponding logical depression on the hardness curves. At the points of peak, for all practical purposes, the mechanical behavior of the two types of samples is identical, no matter which system of thermal treatment was employed. However, no microscopical explanation can be offered of the phenomena by merely comparing the pertaining microstructures of the samples represented in figures 3 and 6. Figure 3 represents the structure obtained in treatment A at 600 C., whereas figure 6 represents the structure obtained in treatment B at 600 C. Figure 3 illustrates a coarse acicular eutectic structure, whereas figure 6 shows an equiaxed  $\alpha$  grain structure in a very fine acicular eutectic matrix. They are basically different microstructures, having similar mechanical peak properties.

As crystallographic X-ray analysis did not reveal in either case any retained  $\beta$  phase, the phenomena are attributed to identical grain boundary concentrations and to the subduance of age hardening in samples where the final treatment temperature in both treatments is kept only slightly above the eutectic temperature of the alloy.

It is of interest to note that basically different microstructures, resulting from basically different heat treatments of the same non-ferrous alloy, are able to exhibit identical peak mechanical properties. Both treatments were tried in service on the same type of chemical machinery and both were found to give excellent results without impairment of the chemical resistance of the alloy. Therefore, the choice of the type of the heat treatment may be left to the heat treater for his convenience. • • •



FIG. 6. Magnification 150 x. Etch: potassium bichromate followed by ferric chloride. Furnace cooled from 800 C. to 600 C. and water quenched. Large equiaxed  $\alpha$  grains (white) in a fine acicular eutectic matrix. The mechanical properties of this structure are identical to those represented by figure 3.

FIG. 7. Magnification 150 x. Etch: potassium bichromate followed by ferric chloride. Furnace cooled from 800 C. to room temperature.  $\alpha$  (white) and  $\beta$  (black) grains embedded in a fine eutectic (grey) matrix.



# Properties of Various Heat Treated

## Steel-Bonded Carbides

### *Martensitic Steel Bonded Titanium Carbide*

MARTIN EPNER  
Chief Metallurgist  
Sintercast Division  
Chromaloy Corporation

WITHIN THE PAST THREE YEARS, a new family of materials, the steel bonded carbides, have been introduced to industry. These materials are hybrids resulting from the crossing of tool and alloy steels with cemented carbides. They have been bred to the needs of industry and offer properties, which at present are not available in any single material. The steel matrix, according to its composition, may offer some properties normally found in steels: machinability, heat treatability, weldability, corrosion and heat resistance. The carbide offers its extreme hardness, wear resistance and rigidity. In combination, these attributes lead to the machinable, heat treatable, weldable carbides known as Ferro-Tic.

This paper is devoted to the description of two grades of Ferro-Tic, each with distinct properties. These contain materials which are heat treatable, and machinable. The steel bonded carbides described are powder metallurgical products made by using substantially standard cemented carbide manufacturing techniques. The five steps in the manufacture of blanks ready for fabrication by a user are:

1. Appropriate powders are mixed by ball milling.

Presented before the Western Engineering Conference and Exhibit, Los Angeles, California.

2. The blended powder is pressed into briquettes of desired size and geometry. Presently, discs up to 1½ in. thick by 6 in. diameter stock size are being supplied to customers.

3. The compacts are liquid phase sintered at temperatures depending on the matrix composition.

4. The sintered, fully dense, blanks are then subjected to an annealing identical to that used for many tool steels and are dependent on the matrix composition.

5. The last step entails machining to stock size. This may be a centerless ground rod with tolerances of +.001 in. - .000 in. or just a rough cored blank.

Both of the materials discussed are based on titanium carbide as hard phase. This particular carbide offers the advantages of low cost, ready availability, very high hardness, and high thermodynamic stability. This last property is of importance because once the composite structure has been formed, the titanium carbide acts as a relatively inert phase during the heat treatment of the matrix.

#### **Ferro-Tic "C"**

The first type of steel bonded carbide made available and the most widely used grade is Ferro-Tic "C". This material is a machinable, heat treatable carbide and consists of 45 volume per cent titanium carbide and 55 volume per cent of a chromium-molybdenum alloy steel. Table 1 gives the nominal composition of this grade. The titanium indicated is entirely combined as carbide while a small part of the carbon indicated is available in the steel for heat treating reactions. Experiments have shown that most of the molybdenum forms a solid solution carbide with the titanium carbide present during sintering. The remainder of molybdenum as well as most of the chromium is in the steel available as alloying elements. Because of these side reactions only about 1.4% chromium is in the matrix, while less than .2% molybdenum appears to remain in the steel after sintering. Figure 1 illustrates the microstructure of Ferro-Tic "C" in the annealed condition where the matrix is entirely spheridic. In the annealed condition it exhibits a hardness of Rc 38-42; after oil quenching from 1750 F., the hardness is Rc 70 or higher.

In the annealed condition the material possesses one all important property, its ability to be machined. In the annealed condition at a hardness of about Rc40, this steel bonded carbide can be machined using normal techniques and tools, and yields chips in most operations similar to cast iron. In fact, the material machines

considerably easier than would be expected for a substance of this hardness.

The reason for this phenomenon is that in the annealed condition the steel matrix is dead soft and the hardness exhibited is that of a composite of very soft steel and very hard carbide. In the chip removal machining operations, the tool for the most part cuts the soft steel rather than the carbide. Consequently, machining is not too difficult.

After machining to a desired shape, a Ferro-Tic tool is heat treated with conventional tool steel heat treating techniques, namely austenitizing at 1750 F. in controlled endothermic atmosphere and quenching into oil. From this operation the user gets a tool whose hardness is Rc70-72, and with a microstructure as shown in Figure 2.

Of interest at this time is the relative lack of distortion of tools made of Ferro-Tic during heat treatment. The distortion obtained upon the heat treating of tool steels is primarily due to the change in lattice structure and size from austenite to martensite and the accompanying strains. Ferro-Tic "C" is only 55 volume per cent steel. For this reason alone, the size change during heat treatment would be approximately halved. The restraining effect of the titanium carbide tends to still further decrease size change. The result is a tool which may be machined almost to final size while still soft, and then heat treated. Depending on the tolerance, the hard tool may be put to work without further finishing. Experiments are under way to determine, quantitatively, the size change in Ferro-Tic "C" during heat treatment.

After hardening, the tool may be tempered to develop different properties. See figure 3. For maximum wear, only a stress relieving at 300-400 F. for 15 to 20 minutes is necessary. Where greater strength is desired, higher tempering temperatures may be employed.

Miscellaneous properties of Ferro-Tic "C" of interest are:

1. The relatively low density, 6.5 gm/cc for grade "C" versus 7.8 gm/cc for steel or about 12 gm/cc for cemented tungsten carbides. It has been used for wear in some applications where it is a rapidly moving part and because of its low density, exhibits lower inertia and less wear and abuse on other parts of the machine.

2. The compressive strength indicated for the hardened material is over 360,000 psi. The exact value could not be determined at the time of these tests, since

TABLE 1. Properties of Chromium-Molybdenum Bonded Titanium Carbide (Ferro-Tic "C").

Composition:

Ti 26% C 7% Cr 2% Mo 2% Fe Balance

Physical Properties:

Hardness: Full Annealed 38-43 Rc  
As Quenched 69-72 Rc

Density 6.58 - 6.56 gm/cc

Modulus of Elasticity  $44 \times 10^6$  psi.

Compressive Strength 360,000 psi.

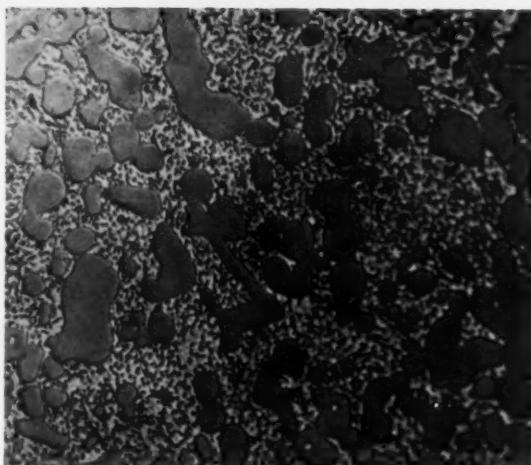


FIG. 1. Chromium-Molybdenum Steel Bonded Titanium Carbide Annealed. 750 x 3% Nital etch.

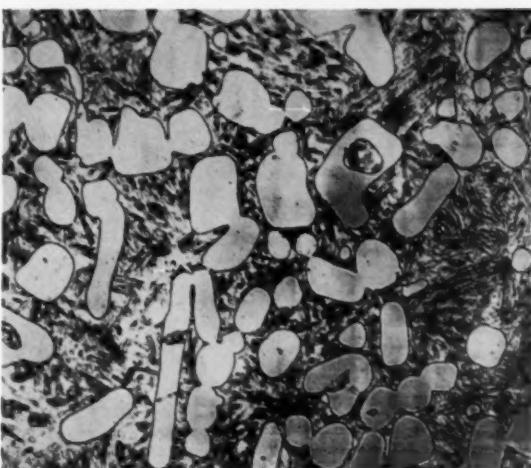


FIG. 2. Chromium-Molybdenum Steel Bonded Titanium Carbide Hardened. 750 x 3% Nital etch.

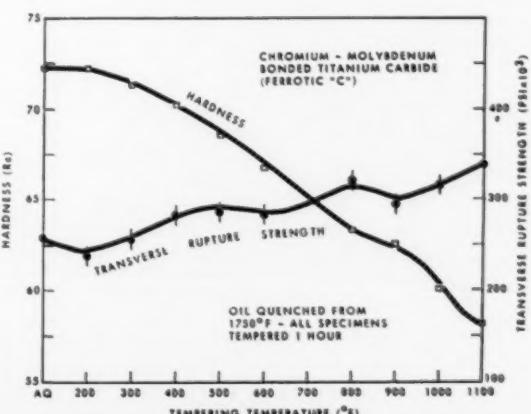


FIG. 3. The effect of Tempering Temperature upon the Hardness and Transverse Rupture Strength of Chromium-Molybdenum Bonded Titanium Carbide.

the bearing blocks on the test machine repeatedly broke before the test specimen. The result reported is the highest value obtained. This was not a failure of the test specimen, but of the cemented tungsten carbide test blocks.

3. The modulus of elasticity is 44 by  $10^6$  psi. This value is somewhat higher than steel but not quite as high as for a cemented tungsten carbide.

4. The ferro-magnetic properties may offer advan-

tages during the machining operation where parts may be held with magnetic chucks or similar devices.

5. The coefficient of thermal expansion of Ferro-Tic "C" may be seen in Table 2. This material being approximately one-half carbide and one-half steel leads it to exhibit a coefficient part way between these materials.

6. Ferro-Tic can be welded, a property heretofore unknown in a carbide. Simple normal techniques of welding with inert gas shielded arc are quite satisfactory for joining it to any one of many steels.

7. It is made of materials low on the critical materials list and would thus be available when many other tool materials might be difficult to obtain.

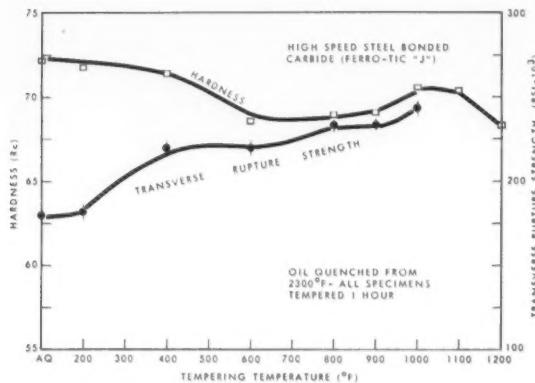


FIG. 4. The Effect of Tempering Temperature upon the Hardness and Transverse Rupture Strength of High Speed Steel Bonded Carbide.

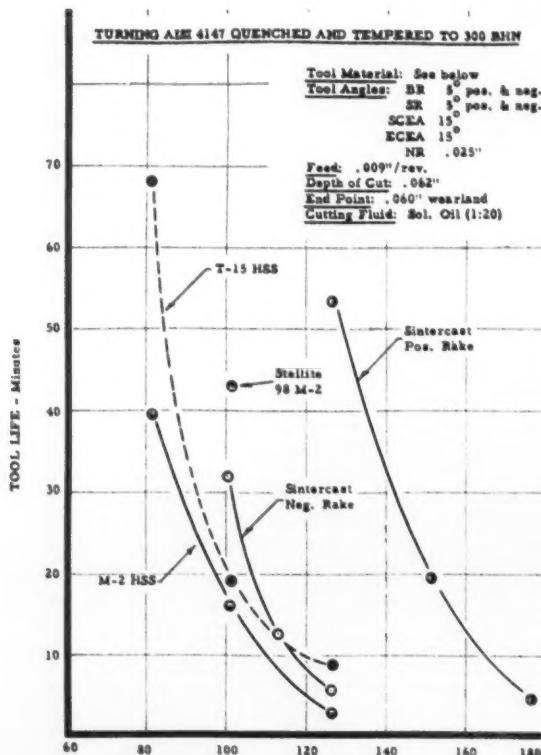


FIG. 5. Cutting Speed - ft./min.

TABLE 2. Coefficient of Thermal Expansion of Chromium-Molybdenum Bonded Titanium Carbide (Ferro-Tic "C").

Temperature Range (Degrees C)	Coefficient (Degrees C)
20 - 200	$7.8 \times 10^{-6}$
20 - 300	$8.7 \times 10^{-6}$
20 - 400	$9.1 \times 10^{-6}$
20 - 500	$9.4 \times 10^{-6}$
20 - 600	$9.6 \times 10^{-6}$
20 - 700	$9.8 \times 10^{-6}$

### Ferro-Tic "J"

The newest grade of Ferro-Tic and in many respects the most interesting is the high speed steel-bonded carbide called Ferro-Tic "J". This material is a cemented carbide bonded with a modified high speed steel, offering entirely unique properties. This material, while machinable and heat treatable, is, once hardened, a good cutting tool. In tests carried out by an independent test laboratory, Grade "J" has proved significantly superior in its cutting ability when compared with the most sophisticated of heat treatable, machinable, high speed steels. There are also indications that

TABLE 3. Properties of high speed steel bonded Titanium Carbide (Ferro-Tic "J").

Composition W 34.5% Ti 10.1% C 5.0% Fe 46.4% Cr 2.9% V 1.1%  
Physical Properties:

Hardness: Full Annealed Rc 44-46  
As Quenched Rc 70.5-72  
Tempered (1m- 1000°F) Rc 71-72  
Density: 8.78 gm/cc

under certain conditions, namely up to speeds of about 150 sfm, Ferro-Tic "J" is superior to a cast cobalt type cutting tool. The composition of this material may be seen in Table 3.

This grade is primarily designed to supplement the machinable, heat treatable cutting tool materials, mainly high speed steel. A tool made of Ferro-Tic "J" would be treated essentially as if it were made of high speed steel. First, a blank received in the annealed

Concluded on page 40

# HEAT TREATING ROHR'S RUNWAY STRETCHERS

THOMAS A. DICKINSON  
Associate Editor

COMMERCIAL HEAT TREATERS who in the past thought of superalloys in terms of costly fixtures and even more costly furnaces should be pleasantly surprised to hear of a project recently undertaken at Rohr Aircraft Corp., Chula Vista, California. Among other things, it tends to prove that some exotic metals can be processed for maximal mechanical strength and heat resistance without special equipment.

The project involved the production of thrust reversers—sometimes called “runway stretchers”—because they enable high speed aircraft to land on relatively short runways by converting the thrust of jet engines into braking forces.

The thrust reversers in this case are being made for Lockheed Aircraft's new JetStar executive transport. As indicated by accompanying photographs, they are streamlined doors or nacelles which can be mounted on the aft ends of jet engines.

Retracted, the doors enable a power plant to produce thrust in a normal manner. Fully opened, they reverse the direction of thrust as their name implies.

In order to serve their purpose, JetStar thrust reversers must survive temperatures that can suddenly soar to almost 1200 F. without appreciable fatigue or corrosion due to exhaust gases.

Several heat resistant steels were available to make thrust reversers which would be practical from the performance viewpoint. However, Rohr engineers decided only the A-286 alloy would be equally suitable in terms of producibility. Besides having good fabrication characteristics, they reasoned A-286 could probably be satisfactorily heat treated in a conventional box-type electric Hydryzing furnace without either special atmospheric controls or fixtures.

A-286 is a stainless steel with high nickel and chromium contents. It has excellent mechanical strength at temperatures up to 1300 F., and good oxidation resistance up to 1500 F.

In re-annealing this alloy after it has been either work hardened or fusion welded, Rohr engineers learned it was possible to get very good results simply by maintaining a temperature of  $1800 \pm 25$  F. one hour for each inch of metal thickness.

*Concluded on page 40*

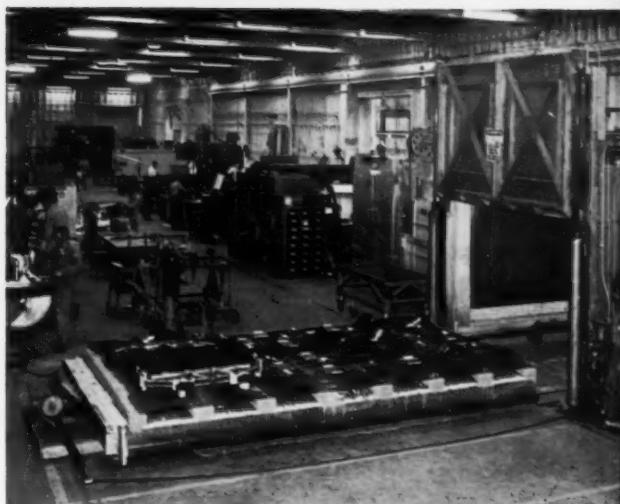


FIG. 1. Conventional box type furnace shown at right is used by Rohr in heat treating A-286 thrust reverser components.

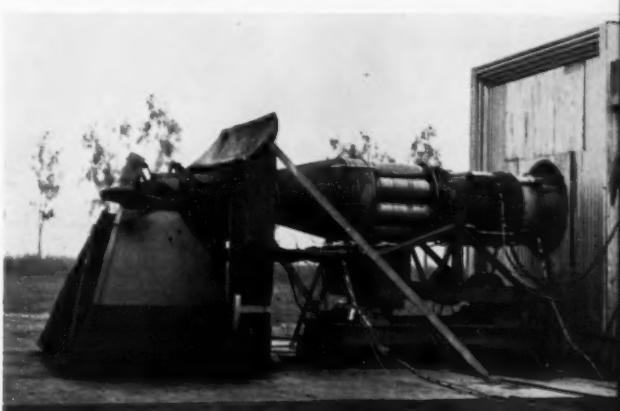


FIG. 2. View of test stand used by Rohr to check thrust reverser performance. Reverser doors have been fully extended for braking action.

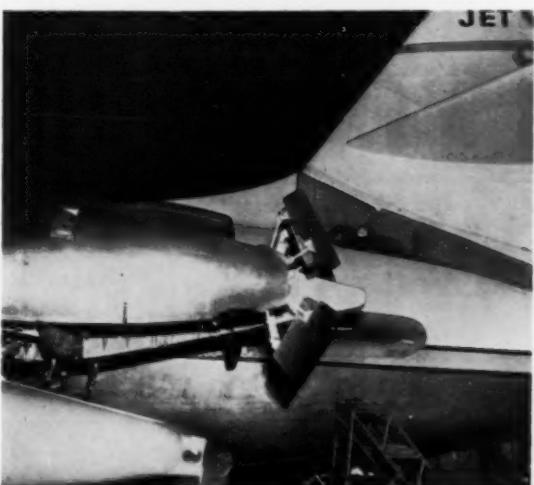


FIG. 3. Side view of JetStar thrust reversers in the process of being extended to the position where they can convert thrust into braking action.

# WHAT WOULD YOU DO?



a problem in labor arbitration taken from the files of the American Arbitration Association

## CASE OF THE SUB-STANDARD MACHINIST

The union contract at a company manufacturing compressors and air conditioning equipment provided for plant-wide seniority, which permitted senior employees to "bump" juniors, in case of layoff. But in order to prevent work standards from deteriorating during periods of reduced operations the contract said that such bumping would have to be *consistent with normal efficiency*.

When layoffs became necessary toward the end of 1959, Harold W., a machinist, asserted his twelve years' seniority to bump into a job in another department. Management balked at this, producing a dossier on Harold which showed: (1) a poor attendance record; (2) a history of substandard work; (3) a foreman's report that Harold required closer supervision than anyone else.

"With a record like that," the industrial relations manager explained to the union, "it wouldn't be consistent with normal efficiency to permit Harold to bump a good machinist off the job. As it is, he's just about a borderline case. If he was any worse, we probably would have to get rid of him even if there weren't any layoffs."

The union objected. "Harold may not be the best machinist in the shop, but you can't make an issue of that now to deprive him of his seniority rights. He hasn't been dismissed for inefficiency and as long as he has the seniority he has the right to bump the junior man off the job."

Eventually, the case went to arbitration under the rules of the American Arbitration Association.

**THE AWARD.** The arbitrator said that it was not the intention of the seniority and layoff clause to permit the company to apply tighter standards of efficiency during

layoffs. The "consistent with normal efficiency" phrase was merely to prevent lowering of standards. As long as the company accepted inferior work from Harold "day in and day out" they had to suffer along with him during the slack period as well. The company had other remedies, he added, that did not involve violation of contractual rights.

## CASE OF THE SHORT-TERM ENLISTEES

Back in World War II, a contract was negotiated at a metallurgical plant providing for 160 hours' pay to employees with six months' seniority who entered the armed forces. This clause was continued after the war because the draft was still on and young men faced several years of military service. Under the circumstances, four weeks' pay didn't seem disproportionate, in terms of what the draftees would lose in regular employment.

In 1955 a new Reserve Forces Act was adopted by Congress, making it possible for boys under 18½ years of age to enlist for three to six months of active duty. It seemed at this point that 160 hours was too much military service pay, but since the company didn't normally hire anyone young enough to have had six months' seniority by age 18½, management didn't bother to try to get the contract changed.

But in January 1957, former President Eisenhower issued an Executive Order raising the age limit for short-term enlistments to 26 years. This made it possible for two employees to volunteer for six months. They signed up and immediately demanded from the company the four weeks' pay specified in the agreement.

Management balked. "That provision of the contract was never intended to cover enlistments of only a few months," the industrial relations manager said. "We

*Concluded on page 33*



## Cast HT high-nickel alloy conveyor belt still going strong after 8 yrs. service at 1550°F

Resistance to sigma phase embrittlement and thermal fatigue . . . high temperature strength and castability make Type HT\* alloy an ideal choice for conveyor belts, baskets, trays and other load-bearing furnace parts.

At one automotive plant, huge 105-ft. conveyor belts—cast of HT high nickel alloy—carry tractor links through continuous, gas-fired hardening furnaces like the one shown above.

And after eight years' service, carrying 3,000 lb. per hour through the 1550°F furnace atmosphere, these conveyor belts are still in operation and expected to give many more years of trouble-free service.

Engineers specified Type HT high-nickel alloy for these parts—for the rollers and idler drums used to rotate them, too—because of this alloy's complete freedom from sigma phase embrittlement, its strength and ductility. These properties, combined with this alloy's casting ease and economy, make it an ideal choice for conveyor belts, baskets, trays and other load-bearing members used in heat treating furnaces.

**Wide range of alloys.** Type HT alloy is just one of a family of high-nickel alloys available for heat-treating applications. In this family of alloys you'll find metals that provide good strength and long life at temperatures from 1200

to 2300°F. You'll find alloys with remarkable combinations of properties—properties needed to withstand oxidizing and reducing environments, carburizing and nitriding atmospheres.

**If you have a high-temperature problem,** there's a good chance you can solve it with the help of the 72-page booklet, "Heat Resistant Castings, Corrosion Resistant Castings . . . Their Engineering Properties and Applications." Write Inco for your copy today. Just ask for A-266.

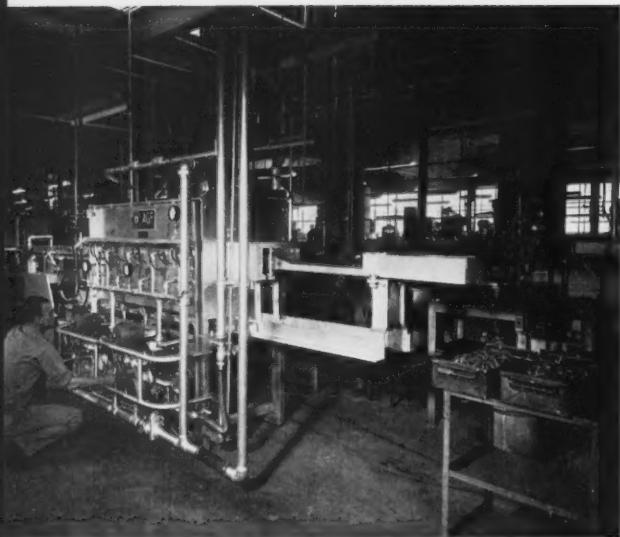
\*A.C.I. designation

**The International Nickel Company, Inc.**  
67 Wall Street  New York 5, N. Y.

# INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

For further information circle No. 81



*The American Gas Furnace Company's reciprocating hearth furnace installation at John Hassall, Inc. in Westbury, Long Island.*

YEARS AGO The American Gas Furnace Company recognized that in heat treating parts there was a distinct advantage in having the work pieces in motion during treatment to assure uniformity of treatment. To accomplish this the rotary retort and shaker hearth furnaces were first invented and later developed. These furnace types overcame the principal disadvantages of the conveyor furnace wherein the parts rested or remained stationary on trays or on the conveyor. By eliminating continuous "point to point" or "surface to surface" contact, rotary and shaker hearth furnaces provided uniform heating and equal exposure to the processing atmosphere, making it possible to light case carburize or case harden parts continuously with the assurance that each piece was receiving the same treatment as every other piece.

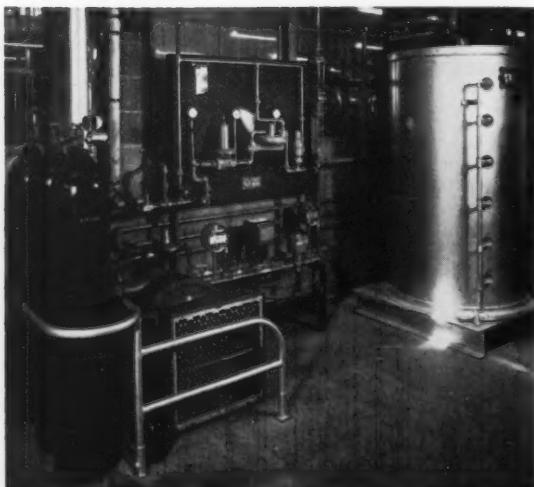
Recent developments have resulted in the AGF shaker hearth and continuous rotary style furnaces being improved. Known as AGF Automotion Furnaces, they help users by offering advanced production heat treating methods by incorporating the advantages of continuous and automatic processing with movement or motion of the parts while they are being heated.

## AGF Automotion-Improved Furnace

### **Heat Treating**

### **Case Histories**

#### **— Case No. 4**



*An Ammonia Dissociator provides ideal controlled atmosphere for the reciprocating hearth furnace installation.*

In the shaker hearth type of furnace the parts travel along a grooved or smooth work conveying hearth by their own momentum. As the parts move along step by step, each is individually and uniformly heated.

The shaker hearth furnace eliminates the use of moving parts or conveyors in the heat thus minimizing maintenance. Only parts enter and leave the heating chamber—thus assuring efficient operation.

The improved automotion furnaces offer completely automated production units with feeder, automatic quenching tank and tempering equipment. Modifications of standard equipment are available to suit any specific application and the following typical installations indicate the wide and diverse range of applications to which these furnaces can be applied.

At the downtown New York plant of Handy and Harman one of these furnaces is used to anneal precious metal blanks. Control of processing must be exact to achieve the desired degree of anneal and to control the grain size.

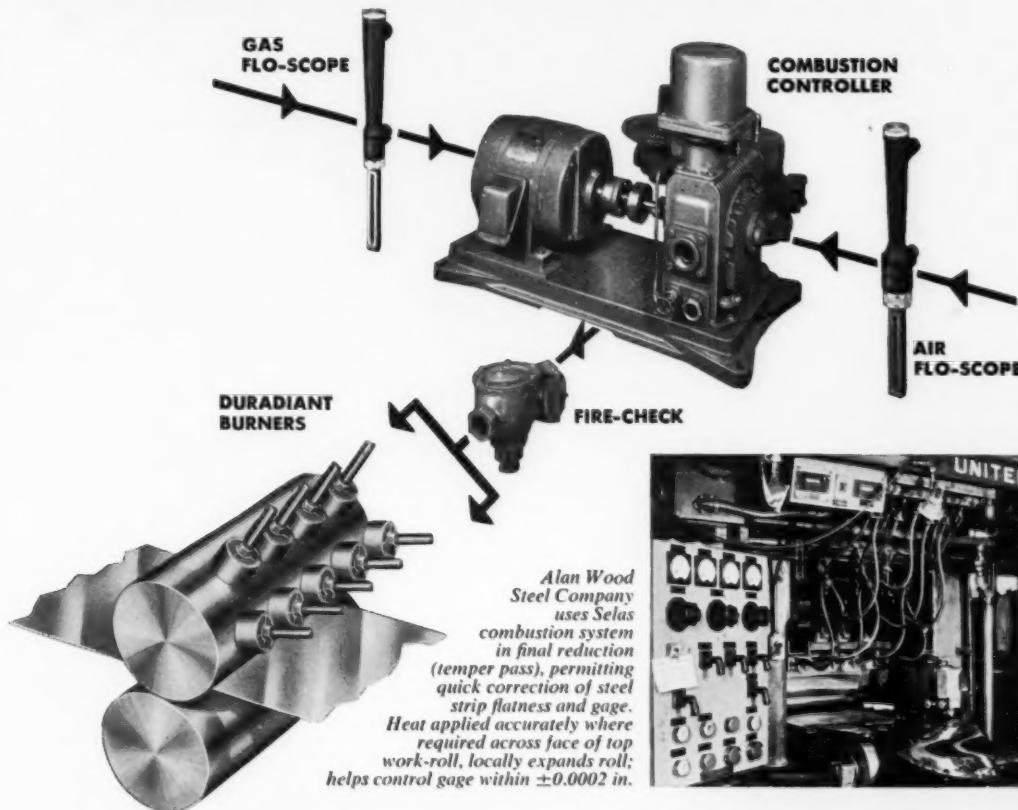
The operating advantages of the automatic shaker hearth furnaces—which include uniform heating and minimum maintenance—led John Hassall, Inc., to select this type of furnace for their expanded heat treating facility in their new plant at Westbury, Long Island. The flexibility of the furnace is indicated by its ability

*Concluded on page 41*



NEW SLANTS ON HEAT PROCESSING FROM SELAS

## Individually—or as a package—Selas combustion tools will improve your heat processing!



Selas combustion components are available individually, or as a complete combustion package, to meet your heat processing needs. The Selas combustion system illustrated above consists of:

- **Durariant® Burners** — generate high intensity radiant heat for controllable fast heating without flame impingement. Durariant Burners can be utilized in open arrangements . . . in-line . . . in circular rings . . . in spirals . . . individually . . . in opposed pairs. (Bulletin 62A)
- **Combustion Controller** — by delivering gas-air mixture to burners at preset ratio and pressure, makes possible fast heating and close control. Completely automatic . . . no labor required in its operation. Factory Mutual approved. (Bulletin 62B)
- **Flo-Scopes®** — installed at the inlets to the Combustion Controller, measure rates of flow of gas and air and permit accurate determination of gas-air mixture ratios. (Bulletin 62C)
- **Fire-Check** — gives complete assurance of safety by

automatically extinguishing any flashbacks that may occur. Factory Mutual approved. (Bull. 62D)

Selas also offers other types of burners including Superheat, Refrak, Spear-Flame and Ribbon.

For descriptive literature about any of the above combustion components or information about Selas complete combustion packages, address Mr. P. Berg, General Industry Division.

**SELAS CORPORATION OF AMERICA**  
62 Dresherstown Road, Dresher, Pa.



HEAT AND FLUID PROCESSING ENGINEERS

DEVELOPMENT/DESIGN/CONSTRUCTION

DURARIANT and FLO-SCOPE are registered trademarks of Selas Corporation of America.

For further information circle No. 82

# production carburizing

these exclusive Ipsen features guarantee the finest results for continuous production carburizing.

Enclosed Charging Mechanism

(Pat. No. 2,896,775)

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Baffles for 100% Forced Convection Heating

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Ceramic Heating Tube Mounting

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Ceramic "Flame-Busters"

(Pat. No. 2,861,596)

Ceramic Fan

(Pat. No. 2,730,352)

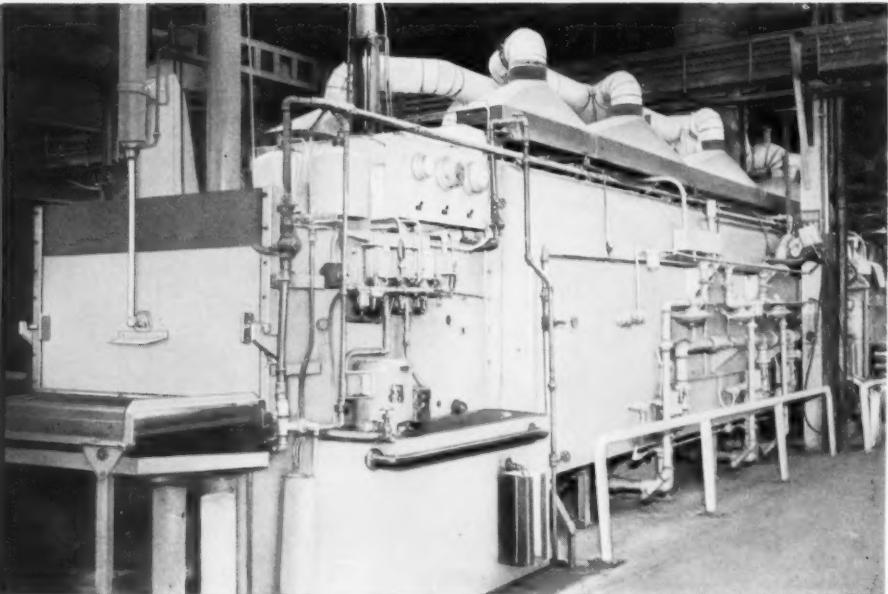
Water-Cooled Fan Motor

(Pat. No. 2,800,317)

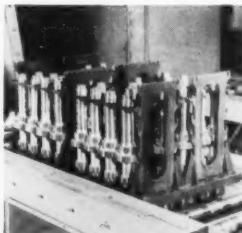
Quench Oil Flow System

(Pat. No. 2,854,013)

Ipsen will build Production Carburizing Furnaces of any desired capacity to give similar results on any production work. Send for Bulletin P-59. Better yet, ask an Ipsen engineer to call and give you complete information relating to your work.



Ipsen 2P-12-2424-GM Double Row 4-Zone Pusher Furnace for Continuous Production Carburizing.



This charge of steel gears, and these countershafts, are typical of work which is being production-carburized in Ipsen furnaces:



IPSEN INDUSTRIES, INC. • DEPT. 733 • P.O. BOX 500 • ROCKFORD, ILLINOIS



# THINK OF THE BIG TAX BITE

*The importance of reform of the depreciation laws has been mentioned from time to time in this magazine, and is a subject of vital importance to everyone connected with the heat treating industry in any facet. The 88th Congress will doubtless give further attention to the subject and the interesting cross-section of opinions presented here is intended to suggest that you keep this in mind and do not fail to contact your Congressman and Senator when the opportunity develops.*

## TAX VOBISCUM

The nation's press is showing increased concern that the American economy is failing to maintain a pace believed necessary to insure industrial world leadership in the deadly duel of the cold war with the Soviet Union.

Newspaper and magazine editorials — during the past 90 days — noted repeatedly that we are not keeping up with the demand for new jobs created by a post-war population explosion. And too, they pointed to the blitz-like invasion of foreign-made goods into our markets at home and abroad.

Why is this happening? The editorials have given the answer — the same answer. A comment by *The Jonesboro (Arkansas) Sun* is typical. The newspaper said, ". . . . one-third of the \$300 billion now invested in American industrial equipment is in need of replacement either because it is worn out or obsolete compared to more modern methods used elsewhere."

Other newspapers noted the worsening condition of America's industrial plants and compared it to the

situation in foreign countries. *The St. Joseph (Missouri) Herald-Press* said, "The growing inroads that foreign products are making in the United States are due not only to cheaper wage rates abroad but to faster, better production from newer equipment."

And there is uneasiness that America's economic troubles will be compounded by the rapid population increase. *The Chicago Daily News* pointed out that 26 million new workers are expected to enter the labor force in this decade compared to only 19 million in the 1950's.

The news publications asked the question — What can be done? *Time Magazine* said, "The swift rise of competition abroad for United States business and the rumblings about recession at home lend a new urgency to a prime question: What must the United States do to create more jobs at home, cut costs and compete more effectively abroad?"

And newspapers and magazines came up with the answer: *Liberalize tax depreciation laws.*

*The New York Daily News* said that manufacturers are "handicapped by old-fashioned tax laws which keep them from writing off the cost of new machinery as fast as they should be permitted to do. This has the effect of keeping them from buying new and more efficient equipment as fast as it is developed. Result: the average age of industrial equipment keeps increasing — which means United States productive efficiency keeps decreasing."

*The Phoenix Republic* said the United States "neglects tax remedies which alone can insure growth . . . and until that defect is corrected America's economy will never realize its dynamic potential . . . .

"Depreciation laws are important because they allow a businessman or a company to deduct from taxable income the cost of new tools and machines, based on the useful life of that equipment."

And *The Birmingham (Alabama) News* said, ". . . unless the tax laws are liberalized as to depreciation, this nation's industry may suffer greatly in meeting world competition . . . . the next Congress should take a fresh look at the tax laws and provide some more depreciation allowances."

*The Binghamton (N. Y.) Sun* said, "Failure to recognize the need for revision of our out-dated depreciation policies places a serious handicap on American progress, production and employment."

And editorials agree that the prospects — if depreciation is liberalized — are for greater government tax revenues rather than less. *The Journal of Commerce* said: "If the liberalization requirements spur as much additional capital spending as its proponents expect, then they would boost the economy and income to a new level whose higher tax receipts would far more than compensate the cost . . . . After all (these) suggestions for increasing the rate of economic growth that do not require more governmental interference with the economy . . . ought to be given a try." • • •

# About People.....

## Lindberg Names Krickl Western Sales Manager

The appointment of John E. Krickl, Lindberg Engineering Company, as western district sales manager has been announced by Carl F. Burling, general sales manager.



John E.  
Krickl

Krickl will be in charge of all sales of the company's complete line of heat treating, process line, melting and holding, induction heating, kiln, salt bath and pilot plant equipment. He has had extensive experience in the application and sales of all types of heat treating equipment. He received his Mechanical Engineering degree from the University of Notre Dame.

Krickl will be headquartered at the Lindberg West Coast plant at Downey, California.

## Connors to Solar Post In Connecticut

Robert E. Connors has been named Solar sales representative for the State of Connecticut. Connors brings to his new position six years of steel service to New England Industry, and a family heritage in the steel business. His father, Thomas Connors, was a well known figure in the steel industry in the area for over 50 years.

A native of Connecticut, Connors makes his home in Bridgeport.

## New Pangborn Manager

Pangborn Corporation, Hagerstown, Maryland, has named Linwood A. Stedman manager of the New England district with offices in Springfield, Mass.

Formerly sales engineer in Springfield, he succeeds John H. Connolly who retired recently after more than 22 years as district manager.

## DePoy Serves Ohio Area

Stewart M. DePoy, former factory manager of the Lakeside Steel Improvement Company, Cleveland, Ohio, is now operating in the Ohio area as a consulting metallurgical engineer and sales representative. He is representing Hyper Alloys, Inc. and Frand W. Faery Company, both of Detroit.



Stewart  
M. DePoy

These related organizations produce heat resisting castings and fabricate furnace accessories from alloys and ceramics. Individual problems are approached from the design standpoint based upon service requirements.

DePoy's entry into sales and consultation brings to the field a wealth of experience and industry know-how.

## Technical Service Manager

The appointment of Jack Morgan as technical service manager of

Foundry Services, Inc. has been announced by David T. Morgan-



Jack  
Morgan

thaler, president of the Cleveland company.

Author of several technical papers, Morgan is also co-holder of patents pertaining to heat treatment of aluminum and magnesium alloys.

In his new position, Morgan will administer the company's extensive program of technical consultation and assistance to foundries.

## Assistant Engineer Post Awarded to W. F. Kast



William  
F. Kast

Loftus Engineering Corp., Pittsburgh, has announced the appointment of William F. Kast to the position of assistant chief engineer. He was formerly a fuel and combustion engineer with United States Steel.

Kast is a graduate of the University of Pittsburgh and a veteran of World War II. William began his career with Loftus in 1955 as a staff project engineer.

## Hevi-Duty V-P Post to Nordstrom

Hevi-Duty Electric Company has announced the appointment of Raymond G. Nordstrom to the newly created post of executive vice president, with responsibilities primarily for the marketing function.

Nordstrom formerly served as executive vice president and general manager of the Reflectal Corporation, Chicago, Illinois, a subsidiary of Borg-Warner Corporation, assistant to the president of Ingersoll



Raymond Nordstrom

Products, Chicago, Illinois, a division of Borg-Warner, and manager of market development for the Torsion-Balance Company, Clifton, New Jersey.

He holds a Fellowship in Metallurgy from the Royal Institute of Technology at Stockholm, Sweden, a Bachelor of Science Degree in metallurgy from the University of Pittsburgh. He also studied marketing at Rutgers University.

## Eliot L. Putnam Named Hawkridge Sales Rep.

Hawkridge Brothers Company, of Boston and Waterbury, Connecticut, has appointed Eliot Lee Putnam as Sales Representative in Worcester County, Massachusetts.

Putnam has been in close contact with the metals needs of New England manufacturers for the past eight years. His knowledge of steel making and its metallurgy is considered outstanding, and he has played an active part in this area's growing use of aluminum.

Eliot's experience includes sales work with Arthur C. Harvey Company, Joseph T. Ryerson, Inc., and Bliss and Laughlin, Inc. He is a graduate of the Deerfield Academy and Harvard College, Class of 1950, where he earned a Bachelor of Arts degree.

## Atmosphere Furnace Specialist Appointed

Lucas S. Miel, President of Commercial Steel Treating Corporation, has announced the appointment of W. R. "Bob" Keough as mechanical engineer, specializing in the design and construction of atmosphere furnaces.

Keough brings to Commercial 20 years of broad and varied experience in the field of heat treating. He holds a Mechanical Engineering degree with strong metallurgical emphasis from the University of Toledo, is a licensed Mechanical Engi-



W. R. Keough

neer in Ohio and Michigan, and is a member of the American Society for Metals and the Professional Engineering Society.

Keough comes to Commercial from Michigan Steel Processing and its affiliate, Atmosphere Furnace Company, where he served as vice president and president respectively. Prior to this, he was District Manager for Ipsen Industries, and for 15 years was a project engineer in the Development Department, Metallurgical Division of Surface Combustion Company.

Keough's appointment is calculated to give added impetus to CST's manufacturing program.

## Joins Pacific Scientific

Latest move to increase Pacific Scientific Company's West Coast Sales Engineering activities is the appointment of Harold C. Farnsworth to the Sales Engineering Staff.

Farnsworth is a graduate of Annapolis Naval Academy. He was formerly sales manager for Duvall Marine.

## H. C. Webb Appointed District Sales Manager

The appointment of H. C. Webb as district sales manager of Haynes Stellite Company's central district, has been announced by R. L. Lerch, vice president. Haynes Stellite Company is a division of Union Carbide Corporation.

F. P. Shephard, district sales manager of this area for the past 25 years, retired on December 31, 1960. Until his retirement, Shephard served in an advisory capacity where his many years of sales and managerial experience were fully utilized.

Webb received a B. S. degree in Mechanical Engineering from the University of Michigan in 1952. While an undergraduate, he was employed by the Engineering Research Center at the University for one and one half years. He later worked as a production engineer in the Aviation Division of Packard Motor Car



H. C. Webb

Company in Detroit. In May, 1953, he joined Haynes Stellite Company as a sales engineer and was assigned to the Detroit area. On March 1, 1960 he was appointed assistant district sales manager, central district.

**TODAY  
THE  
TREND  
IS  
UP**



**Modern specifications  
call for better properties  
achieved by better  
heat treating  
— check with your  
commercial heat treater**

**W**henever a modern product is improved or a new one developed it has now reached a point where the heat treating procedures and processes to be applied to basic component parts are among the original factors to be considered. In the past, fabricating methods and metals were frequently the first to be specified and heat treating, if involved at all, was a secondary problem.

Because of this and because of the new and exceptional design characteristics and ultimate engineering properties which can be achieved only through skillful and accurate heat treating, the tonnage volume of heat treating materials processed by the commercial heat treating industry grows steadily month after month.

There is another reason for this and it is found in the fact that only the commercial heat treater offers practically an all inclusive diversity of plant facilities, but even more important, the accumulation of technical skills, experienced personnel, and the background of knowledge so essential to this field.

If you would like to receive a charted monthly report of the volume of activity in this industry, write us on your company letter-head. We will be glad to send it to you.

Whatever your heat treating problem, always check with your commercial heat treater first.

# THERE'S A HEAT TREATING SPECIALIST NEAR YOUR PLANT

## ALABAMA

**Southern Metal Treating Co., Inc.**  
3131 10th Ave. N., Birmingham 4

## CALIFORNIA

**Downey Steel Treating Co., Inc.**  
9637 Nance St., Downey  
**National Heat Treating Co., Inc.**  
1833 W. Florence, Inglewood 1  
**Certified Steel Treating Co.**  
2454 E. 58th St., Los Angeles 58  
**Lindberg Steel Treating Co.**  
2910 S. Sunol Drive, Los Angeles 23  
**Cook Induction Heating Co.**  
4925 East Slauson Ave., Maywood

## CONNECTICUT

**Commercial Metal Treating, Inc.**  
89 Island Brook Ave., Bridgeport 6  
**Stanley P. Rockwell Co.**  
296 Homestead Ave., Hartford 12  
**Irland Heat Treating Co.**  
512 Boston Post Road, Orange

## ILLINOIS

**Accurate Steel Treating Co.**  
2226 W. Hubbard St., Chicago 12  
**Allied Metal Treating Corp. of Illinois**  
333 N. California Ave., Chicago 12  
**Dura-Hard Steel Treating Co.**  
2112 W. Rice Street, Chicago 22  
**Perfection Tool & Metal Heat Treating Co.**  
1756 West Hubbard St., Chicago 22  
**Fred A. Snow Co.**  
1942 West Kinzie St., Chicago 22  
**American Steel Treating Co.**  
P. O. Box 396, Crystal Lake  
**Lindberg Steel Treating Co.**  
1975 N. Ruby St., Melrose Park  
**Eklund Metal Treating, Inc.**  
721 Beacon St., Rockford  
**Scott Ford, Inc.**  
2719 Fifth St., Rock Island  
**IpseLab of Rockford, Inc.**  
2125 Kishwaukee Street, Rockford  
**O. T. Muchlemyer Heat Treating Co.**  
1500 Preston St., Rockford

## INDIANA

**Quality Steel Treating Company**  
1630 Locust Street, Anderson  
**Industrial Heat Treating & Metallurgical Co., Inc.**  
2131 Northwestern Ave., Indianapolis 2

## MASSACHUSETTS

**Kinetics Corporation, a Division of High Vacuum Equipment Corp.**  
2 Churchill Road, Hingham  
**Porter Forge & Furnace, Inc.**  
74 Foley St., Somerville 43  
**New England Metallurgical Corp.**  
475 Dorchester Ave., South Boston 27  
**Springfield Heat Treating Corp.**  
99 Margaret Street, Springfield  
**Greenman Steel Treating Co.**  
284 Grove St., Worcester 5

## MICHIGAN

**Anderson Steel Treating Co.**  
1033 Mt. Elliot Avenue, Detroit 7  
**Bosworth Steel Treating Co.**  
18174 West Chicago Blvd., Detroit 28  
**Commercial Steel Treating Corp.**  
6100 Tireman Ave., Detroit 4  
**Commonwealth Industries, Inc.**  
5922 Commonwealth Ave., Detroit 8  
**Vincent Steel Process**  
2424 Bellevue Ave., Detroit 7  
**State Heat Treat, Inc.**  
520 32nd Street, S. E., Grand Rapids 8  
**Royal Oak Heat Treat, Inc.**  
21419 Dequindre, Hazel Park

## MISSOURI

**Lindberg Steel Treating Co.**  
650 East Taylor Ave., St. Louis 15  
**Paulo Products Co.**  
5711 West Park Ave., St. Louis 10

## NEW JERSEY

**Fred Heinzelman & Sons, Inc.**  
790 Washington Avenue, Carlstadt  
**American Metal Treatment Co.**  
Spring and Lafayette Sts., Elizabeth  
**Benedict-Miller, Inc.**  
Marin Ave. & Orient Way, Lyndhurst  
**Bennett Heat Treating Co., Inc.**  
246 Raymond Boulevard, Newark 5  
**L-R Metal Treating Corp.**  
107 Vesey St., Newark 5  
**Temperature Processing Co., Inc.**  
228 River Road, North Arlington

## NEW YORK

**Owego Heat Treat, Inc.**  
Rural Route 1, Apalachin  
**Eastern Heat Treating & Brazing Corp.**  
44 Sea Cliff Avenue, Glen Cove  
**Alfred Heller Heat Treating Co., Inc.**  
391 Pearl St., New York 38  
**Lindberg Steel Treating Co.**  
620 Buffalo Road, Rochester 11  
**Rochester Steel Treating Works**  
962 Main Street, E. Rochester 5  
**Syracuse Heat Treating Corp.**  
1223 Burnet Ave., Syracuse 3

## OHIO

**Queen City Steel Treating Co.**  
2980 Spring Grove Ave., Cincinnati 11  
**Ferrotherm Co.**  
1861 E. 65th St., Cleveland 3  
**Lakeside Steel Improvement Co.**  
5418 Lakeside Ave., Cleveland 14  
**The Modern Steel Treating Co.**  
5466 Lake Court, Cleveland 14  
**George H. Porter Steel Treating Co.**  
1273 East 55th Street, Cleveland 3

## OHIO — (Cont'd)

**Reliable Metallurgical Service, Inc.**  
3827 Lakeside Ave., Cleveland 14  
**Winton Heat Treating Co.**  
20003 Lake Road, Cleveland 16  
**Dayton Forging & Heat Treating Co.**  
2323 East First St., Dayton 3  
**Ohio Heat Treating Co.**  
1100 East Third St., Dayton 2

## PENNSYLVANIA

**Drever Company**  
Red Lion Rd. & Philmont Ave.,  
Bethayres

**Robert Wooler Company**  
Dresher

**Wiedemann Machine Co.**  
Gulph Road, King of Prussia

**J. W. Rex Co.**  
Eighth and Franconia Avenue,  
Lansdale

**Lorenz & Son**  
1351 N. Front St., Philadelphia 22

**Metlab Company**  
1000 E. Mermaid Lane, Philadelphia 18  
**Pittsburgh Commercial Heat Treating Co.**  
49th St., and A.V.R.R., Pittsburgh 1

## TENNESSEE

**Mid-South Metal Treating Co.**  
463 Scott St., Memphis 12

## TEXAS

**Dominy Heat Treating Corp.**  
P. O. Box 5054, Dallas  
**Superior Heat Treating Co., Inc.**  
P. O. Box 69, Fort Worth 1  
**United Heat Treating Company**  
2005 Montgomery Street, Fort Worth 7  
**Cook Heat Treating Co., of Texas**  
6233 Navigation Boulevard, Houston 11  
**Houston Heat Treating Company, Inc.**  
2100 Quitman Street, Houston 26  
**Lone Star Heat Treating Corp.**  
5212 Clinton Dr., Houston 20

## WISCONSIN

**Allied Metal Treating Corp.**  
P. O. Box 612, Milwaukee 1

**Heat Treating Engineers, Inc.**  
1146 North 54th St., Milwaukee 8

**Metal Treating, Inc.**  
720 South 16th St., Milwaukee 4

**Supreme Metal Treating Co.**  
4440 West Mitchell St., Milwaukee 14

**Thurner Heat Treating Co.**  
809 West National Ave., Milwaukee 4

**Wisconsin Steel Treating & Blasting Co.**  
1114 South 41st Street, Milwaukee 15

**Harris Metals, Inc.**  
4210 Douglas Ave., Racine

All of the above listed firms are members of the

# METAL TREATING INSTITUTE

Box 448,

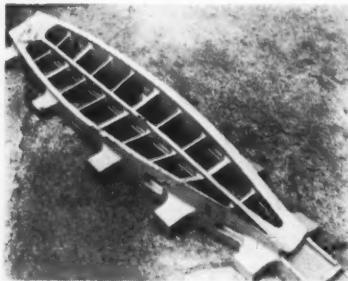
Rye, New York



# NEWS TO HEAT TREATERS...

## **Stainless Brazing Fixture**

Aircraft propellers for prop-jet engines have a major role in the Jet Age as has been proved at the Aeroproducts Operations of Allison Division, General Motors Corporation in Dayton, Ohio. Aircraft propellers manufactured at Aeroproducts are brazed in fixtures like the one shown here. Weighing about



400 pounds, it is a stainless casting of alloy type HN (Alloy Casting Institute designation).

The fixture carries the propeller to be brazed into a pre-heat zone at 1650 F. for a period of about two hours. It then goes into the purified, rich exothermic gas atmosphere of the brazing zone for one hour at 2060 F. Next, it moves into a cooling zone and is brought down to a temperature of 600 F. in about two hours. The final stage consists of an air cooling process.

To resist this damaging cyclic high temperature environment, the iron - nickel - chromium alloy ACI type HN was selected for the brazing fixture casting. The alloy composition, 25% nickel, 20% chromium, offers excellent hot strength up to 2100 F., and good life under rapidly fluctuating temperatures. The HN alloy gives satisfactory service in a number of specialized applications, notably brazing operations.

**For further information circle No. 2**

## **The "Sortationer"**

The Sortationer will differentiate between various aluminum alloys, magnitude alloys and copper alloys by indicating the difference in conductivity of a layer near the surface. By special arrangement of the circuit, the sensing head has been made relatively insensitive to distance. Unlike other instruments it will give a virtually constant reading even if the head is not kept absolutely square on the surface or if the surface is uneven. It will also give constant readings whether the surface is anodized, painted, or both.

The Sortationer can be used to identify specific materials when they have lost their identity marks, to show degree of heat treatment, to distinguish in many instances between annealed and unannealed Alclad, to show heat damage to many treated alloys, to indicate which side of single sided aluminum coated shell is clad and to indicate the degree of heat treatment of a particular alloy acting as a "go, no-go" gauge in heat treating processes.

Also, it will differentiate pure aluminum and pure magnesium from all their alloys and will also differentiate between tantalum and niobium and between gold and silver and their alloys.

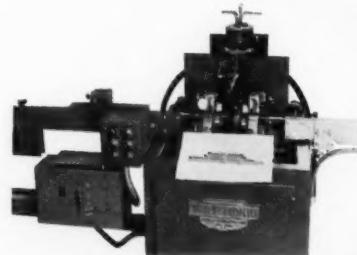
**For further information circle No. 12**

## **Progressive Hardening Unit**

A continuous feed, progressive hardening machine which handles varying lengths of steel rods at a rapid rate provides a vital and compact link in one southern factory's automation system. Designed by Ther-Monic engineers and built by Induction Heating Corporation in

Brooklyn, New York, it speeds production of automotive shock absorber shafts at Heckethon Manufacturing and Supply, Ayersburg, Tennessee.

Applying the useful process of induction heating, the machine hardens a narrow band as the shaft



progresses and rotates through the work coil at a uniform rate. The small heating area allows even long pieces of work to be hardened with a moderate capacity generator. The machine occupies only a minimum amount of space. The quenching mechanism is an integral part of the work coil.

The coil can be adjusted to handle shafts of 0.453 and 0.484 in. outside diameter. Hardening occurs only in the skin of the shaft, at the greatest diameter, and the smaller ends are left untreated. Rate of progress through the machine allows as many as 250 shafts 9 in. in length to be hardened in an hour. Shafts varying in length from 5 1/2 to 13 in. can be handled.

**For further information circle No. 6**

## **Ipsen Ceramic Brick**

As a result of its continued research and development in the field of high temperature insulating materials, Ipsen Industries, Inc., announces a new ceramic insulating

brick that withstands temperatures to 4200 F. This material was developed at the company's ceramic division, at Pecatonica, Illinois.

Other successful accomplishments of the ceramic division include the development of Ipsen Super Alloyed ceramic material used for radiant tubes, furnace fans, and thermocouple protection tubes. More recently, a lightweight ceramic insulating brick was introduced for applications to 3400 F. This brick is now being produced in limited quantities.

The material most recently developed is known as I. C. B. 4200. It is being formed in standard brick sizes of 2 1/2 in. by 4 1/2 in. by 9 in. Among its properties is a mean thermal conductivity at 2200 F. of less than 1.0, three times the insulating value of a 2600 I. F. B. It has an 89% porosity and weighs approximately two lbs. per brick.



Melting point of the brick is 4620 F. It has a temperature limit of 4200 F. in oxidizing atmosphere, in nitrogen, and in hydrogen atmosphere. Other hot face temperature limits include 4200 F. under vacuum conditions, 3000 F. in a reducing atmosphere with carbon present, 2200 F. in contact with SiC, 3000 F. in contact with SiO<sub>2</sub> or Al<sub>2</sub>O<sub>3</sub>. The material is readily cut, sawed or filed.

This insulating ceramic material is expected to have applications in the nuclear field as well as in the space vehicles field. In the metallurgical field, it has immediate acceptance for very high temperature applications. I. C. B. 4200 is presently being used in a combination vacuum atmosphere furnace oper-

1952						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

# ORIGINAL

instrumentation for most  
precise temperature control

**NOW UNIVERSAL:**  
controls the most unstable temperature systems

*Gardsman*  
by WEST



For any operation requiring precise control of any temperature, through electric heaters, money can't buy a finer instrument. *Infinitely* modulates heater power. No on-off pulses; prolongs heater life and saves power. Now provided with exclusive manual switch and adjustable maximum and minimum input control. *Tubless*. Compact. Requires least maintenance and operating attention.



The most compact programming system available includes Model JSBG (left) for any operation involving a time-temperature cycle. Its simply cut cams integrate and control time with temperature.

Check the features that permit longer runs, assure uniform top quality, cut operating costs. Ask your West representative or write direct for Bulletin JSB and JG.

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For further information circle No. 84

## NEWS TO HEAT TREATERS

ing at 4200 F. for sintering of high temperature materials. Current production rates are on a laboratory basis.

*For further information circle No. 11*

## Age Hardening Retarded

Age hardening of aluminum rivets and blanks can be retarded and annealing temperatures reduced by the use of Cincinnati Sub Zero Chilling unit.



Model B-10 shown here, is designed to operate at a holding temperature of -40 F., is caster mounted and can be rolled from job to job. Current may be off for as long as one and one half hours before there is a noticeable rise in temperature. Much longer time is required to bring the unit up to critical temperature.

Chamber dimensions: 26 in. long by 18 in. wide by 20 in. deep.

External dimensions: 32 in. long by 24 in. wide by 46 in. high.

Five removable racks hold 50 cannisters two in. dia. and 10 in. long. The lifetime silent signal remains on during operation and is off only in the event of power failure. Temperature regulation from +20 F. to -40 F. is manually regu-

lated and observed by means of an indicating thermometer.

*For further information circle No. 5*

## Sola-Jet Ovens

Sola-Jet Radiant Ovens from Temperature Engineering Corporation are said to be the first new concept in absolute constant controlled temperature since the advent of the automatic thermostat. According to the manufacturer, Sola-Jet Ovens solve the problem of exacting temperature tolerances directly onto the work load with heaters placed on all six sides of the chamber.

Specially designed "jack-in" heated aluminum shelves for applying direct heat to the work load are optional. Modifications are engineered by Tempcor to meet specific needs. The units are a product of Temperature Engineering Corp., Riverton, N. J.

*For further information circle No. 1*

## A Symposium Scheduled On Nondestructive Testing

The Second Annual Symposium on Nondestructive Testing of Aircraft and Missile Components (unclassified) will be held February 14 through 16, 1961, at the Gunter Hotel, San Antonio, Texas.

Sponsored by South Texas Section of The Society for Nondestructive Testing, Inc., and Southwest Research Institute, the symposium shows promise as an outstanding industry attraction.

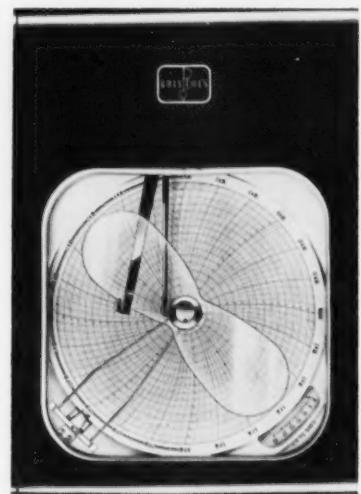
*For further information circle No. 9*

## New Bristol Unit

The Bristol Company is now offering a single case time program recorder controller in its Series 500 instrument line. The incorporation of the recorder and the controller into a single unit is said to afford

a 50% reduction in panel space requirements.

The recorder chart and the program cam are independently driven. This makes it possible to record repetitions of the program on a single chart. The program time may be from 30 min. to 30 days.

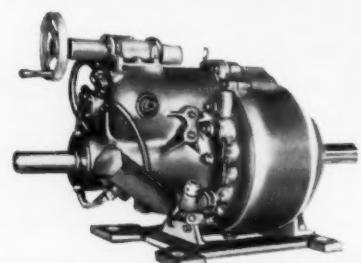


Various models of the instrument measure and control temperature, pressure (including absolute pressure), flow (mercury manometer or bellows differential meter), liquid level, and humidity.

Either pneumatic control or Bristol's Free-Vane electronic control is offered. Pneumatic control can be "on-off", or proportional or reset control. An external manual-automatic station is also available.

*For further information circle No. 3*

## Transmission Innovation



A 10 HP variable speed hydraulic transmission which permits low cost automation and modernization of existing machinery as well as devel-

opment of new equipment to increase production and reduce costs has been introduced by Roberts Electric Company, Chicago. The unit is rated for continuous duty with speeds from 0 to 1600 RPM for heavy duty applications.

Unit drive is set at 1800 RPM or less with any two to 10 HP motor or 20 HP gas engine. Precise speed selection is obtained by rotation of a hand wheel which gives an infinite number of speeds through the unit's entire range.

The transmission has ball and roller bearings throughout and is extremely compact with a weight of 100 lbs. It is 22 in. long, excluding shafts, 13 in. wide, and 16 in. high. Dimensions of the input shaft are 1 3/8 in. diameter, length four inches. Output shaft measurements are 1 5/8 in. diameter, length four inches.

For further information circle No. 36

### Plant in Florida

Tangible evidence of the industrial growth taking place in Florida is found in the establishment of a



new commercial heat treating company in Fort Lauderdale known as Rex of Florida, Inc. The new plant will provide metal treating services needed by many present manufacturing operations throughout the state.

Operations began early in January and a complete range of heat treating facilities and processes are available. Metal plating services will also be provided, including gold, silver, copper and chromium.

The plant is located at 36th Street and 18th Avenue S.W., Ft. Lauderdale, Florida, adjacent to Broward County International Airport.

For further information circle No. 35

### Constant Voltage Supply

The new Constant Voltage Supply introduced by West Instrument Corp. is far more than a component for West instruments. It can be



installed on the job to improve results from a wide variety of industrial potentiometers.

The unit avoids all problems resulting from manual or automatic standardization, eliminating the need for standard cells, mechanisms, batteries and associated components. It can replace the battery in any potentiometer recorder, requiring six M.A. or less measuring circuit current at nominal 1.029 V.D.C., including West Marksman recorders.

Listed as Model AA-0600, the unit pictured here operates directly from 100-135 V.A.V. line 50/60 cycles and provides exceptionally precise regulation with highly accurate temperature compensation. It can also be used for a bridge circuit power supply with slight degrading of voltage regulation.

Compact and economical, Model AA-0600 includes mounting plate.

For further information circle No. 8

### Heat Treat Baskets

Rugged, long life heat treat baskets that allow more payload than previously possible have been developed by Ipsen Industries. De-

signed for use in controlled atmosphere and vacuum units, these baskets feature tray and woven mesh liners constructed of inconel. The maximum strength at elevated temperatures exceeds the fondest expectations. Minimum thermal distortion has been evident in prolonged tests. The open area of the basket permits maximum heating and quenching rates.

Featuring interlocking stacking arrangement, the basket is fortified by pressure resistant welding.

For further information circle No. 10

### D & M's Mineor FM Offered in Hollow Form

A deep-hardening, nondeforming tool steel with free machining properties has been developed by Dar-



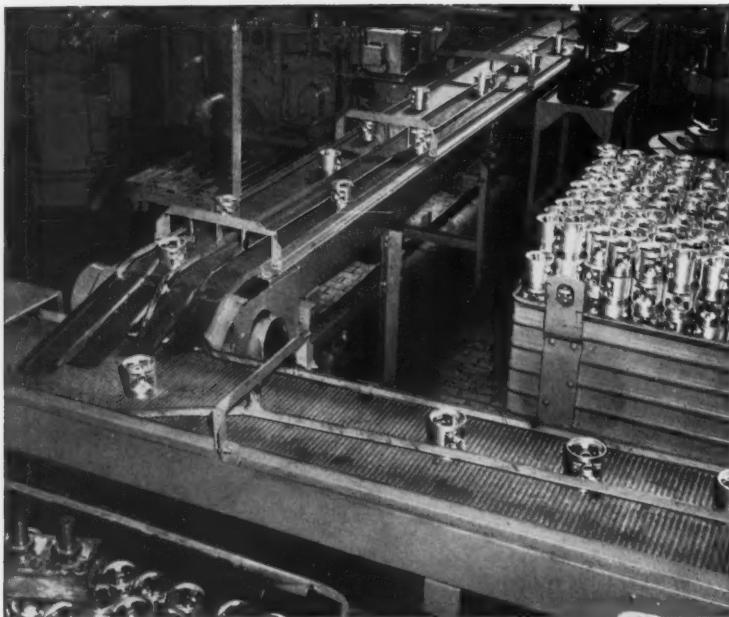
win and Milner, Inc., Cleveland. The property adds a carefully controlled addition of minute, uniformly dispersed alloy sulfides and imparts superior machinability to the steel, as well as a self lubricating action for die parts without sacrificing mechanical strength.

According to the manufacturer, Mineor FM is ideal for delicate parts where oil hardening steel might distort or crack. Other advantages of its use are found in blanking and shearing of dies for heavy materials and its machinability, which allows it to be cut to short lengths for sleeves, bushings, and guides.

Overall machining makes the Mineor FM hollow bar free from decarburization and ready for finish machining. Its composition is 1.0 C,

Continued on next page

## Continuous Heat Treating Depends on Continuous Product Flow and...



Aluminum piston heads flow on Ashworth Balanced Weave design B 60-38-14. It affords the required smooth surface characteristics to facilitate transfer and minimize product marking.

## ASHWORTH KEEPS YOUR PRODUCT ON THE MOVE...CONTINUOUSLY!

In brazing, hardening, quenching, annealing, tempering, washing, sintering . . . any operation that demands continuous product flow . . . Ashworth Metal Process Belts can help you reduce handling and maintenance costs.

Ashworth Metal Process Belts can be fabricated from any metal or alloy . . . with any required surface characteristic. Skilled Ashworth Engineers have designed these belts to withstand and operate at temperatures up to 2100°F. Ashworth open mesh design permits circulation of processing atmosphere, or free drainage of process solutions in quenching, pickling and tempering.

Engineering, plus accurate selection of wire analysis, plus careful fabrication insure quality woven into every Ashworth belt. You can depend on Ashworth to carry the load . . . continuously.



Consult your nearest Ashworth Sales Engineer  
or write directly to:

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WINCHESTER, VIRGINIA  
Sales Offices In Principal Cities

For further information circle No. 85

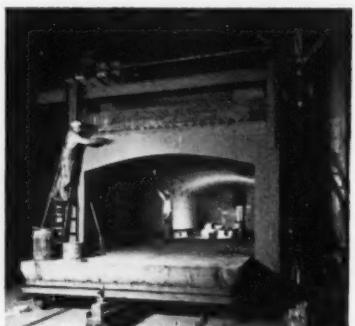
0.5 Mn, 0.3 Si, 5.0 Cr, 0.25 V, and 1.1 Mo. The steel hardens between 1750-1775 F. to give 63 to 65 Rockwell C. It can be drawn back to any required hardness. Izod impact strength of Mineor FM hollow bar (un-notched specimen) at Rockwell C 62.5 is 104 ft. lbs.—much higher than any other tool steel at this hardness.

Mineor FM hollow bar is available in a range of sizes, from  $2\frac{1}{4}$  to  $16\frac{1}{4}$  in. O.D., and  $\frac{3}{4}$  to  $9\frac{3}{4}$  inches I.D., with wall thicknesses from  $\frac{3}{4}$  to  $4\frac{1}{2}$  in. Surfaces are rough machined, leaving  $\frac{1}{8}$  in. for finishing.

For further information circle No. 37

## P.C.H.T. Installs Giant Heat Treating Unit

Pittsburgh Commercial Heat Treating is installing one of the nation's largest heat treating furnaces, designed to meet the precision



needs of the missile age. This month's cover shows the giant furnace in action. This new gas fired furnace measures 12 ft. by 5 ft. by 40 ft. and is equipped with the latest automatic temperature recording devices to assure constant accuracy.

The furnace will initially treat huge cylinders used as gas storage tanks at missile launching sites. These cylinders are heated to 1600 F., and then quickly quenched in the adjacent 8 ft. by  $37\frac{1}{2}$  ft. long by 7 ft. wide quench tank.

Continued on page 36

# "PARK HEAT TREATING SALTS help us harden tools properly"

SAYS O. J. WILLIAMS SR., PRESIDENT OF METAL TREATING INC., CINCINNATI, OHIO.



Left to right: O. J. Williams Sr., President; O. J. Williams Jr., Chief Metallurgist; George Theurer, General Manager & Treasurer; James F. Hetz, Park Sales Representative.

"Our customers appreciate the high quality of our work and we appreciate the high quality of Park heat treating salts. They furnish rapid, uniform heating without distortion and with no decarburization, pitting or scaling. Our production and quality have increased considerably since we started using Park salt baths. We have come to know them as indispensable assets to our tool hardening operations." Molten salt baths are now generally accepted as the ideal mediums for heat treating tool steels. A majority of the country's

leading tool makers and commercial steel treaters use Park salt baths. Tool makers and users are concerned with fine quality and low cost heat treating. Park's heat treating materials and technical service, together with improved salt bath furnace construction, are largely responsible for the vast improvement in the hardening of tools. Park Chemical Company manufactures a complete line of heat treating materials and are happy to help you with your heat treating problems. No obligation, of course. Call or write today.



Woodside Rapid Carburizers (Non-Burning-Charcoal-Coke-Specifications) • Park-Kese Liquid Carburizers • Quenching and Tempering Oils • Cyanide Mixtures • Neutral Salt Baths • High Speed Steel Hardening Salts • Iso-Thermal Quenching and Tempering Salts • Protective Coatings (Non-Carb-No-Kese-No-Scale-No-Tride) • Carbon Products (Charcoal-Crushed Coke-Pitch Coke-Lead Pet Carbon) • Kold Grip Polishing Wheel Cement • Par-Kem Metal Cleaners • Cutting and Grinding Compounds (Kem-Cut — Kem-Grind — Blue Ice) • Aluminum Brazing Salts and Fluxes

**PARK CHEMICAL COMPANY** 8074 Military Avenue, Detroit 4, Michigan

For further information circle No. 86

# MANUFACTURERS' LITERATURE

For your copy circle  
the number on the  
Readers' Service Card

**Box Furnaces With Cooling Chamber** designates Bulletin GED-4180 which in four pages describes General Electric's new box furnaces with cooling chamber. The bulletin tells how the units are designed for copper brazing, silver brazing, sintering, or bright annealing.

For further information circle No. 20

**Characteristics and Typical Applications** of Heppenstall "C" Annealed Die Steel are contained in Data Sheet 8, published by Heppenstall Company, Pittsburgh 1, Pa. "C" Annealed is made from basically the same chemical composition as Heppenstall Hardtem, with the exception that the vanadium content is increased. It is furnished in the annealed condition only for greater ease in machining when a customer desires to heat treat beyond the standard hardness ranges of Hardtem. Although primarily a die steel, it may be used for various machinery components, such as pinion shafting, gears, and other miscellaneous shafting where toughness and abrasion are a factor of performance. The data sheet gives instructions for forging, annealing, hardening, quenching, and tempering, and also gives physical properties.

For further information circle No. 21

H. K. Porter Company, Inc., Refractories Division, has announced the availability of literature on **Magnaram 85** and **Magnaram 95**, air setting, periclase ramming mixes. Both have application in electric furnaces, open hearths and ladles,

and can be used for maintenance or for new construction. The literature defines each, shows where they may be used, user's advantages, shipping data, chemical analysis, screen analysis, installation data and information on where they may be purchased.

For further information circle No. 55

**A new 12 page bulletin** by Pangborn Corporation describes the push-button controlled LK and LM Rotoblast Table-Rooms designed to blast clean various-sized pieces ranging from small parts to castings or weldments up to 10 feet wide weighing as much as six tons. Illustrated field reports show how table-room installations are saving money and man hours on difficult cleaning jobs which were previously done by other methods. In addition to photographs and cut away diagrams, the bulletin gives complete dimensions and specifications of eight table-rooms, including the new "twin-table" type, showing how each may be tailored to particular requirements.

For further information circle No. 56

**A new 12 page technical article** on **Sub-Zeroing** and its benefits to gear and pinion production has been made available. T. J. Frederick, Chief Engineer for Cincinnati Sub-Zero Products has written this article in collaboration with metallurgists at Tool Steel Gear and Pinion. It includes carburizing and heat treat procedures as well as assembly methods.

For further information circle No. 23

**A New Selector Chart**, which enables a metal finisher to match the proper chromate coating to the type of finish desired, is available from MacDermid Incorporated, Waterbury, Conn. In addition to showing the type of finish desired, the Selector Chart indicates the color of various coatings, refers to the appropriate MacDermid data sheet number and lists the government specification number met by the company's three dry powdered chromate conversion coatings; MACro Bright 2, MACro Brite C-9 and MACro Brite L-6.

For further information circle No. 25

**A new brochure** describing available **Uninterrupted Power Supplies** has been issued by the power equipment division of Consolidated Diesel Electric Corp. An Uninterrupted Power Supply, unlike an ordinary automatic standby diesel-generator set, provides absolutely continuous power in the event normal power sources fail. It does not require the diesel engine to start and come up to speed before assuming the electrical load. Rather, kinetic energy stored in a flywheel provides power during the interval required for the diesel engine to reach full power. Two types of UPS units are described in the Condec Catalog.

For further information circle No. 26

**Rolock Ammonia Dissociators** are described in new Catalog Section 25 now available from Rolock Inc.

Continued on page 34

## WHAT WOULD YOU DO?

Concluded from page 16

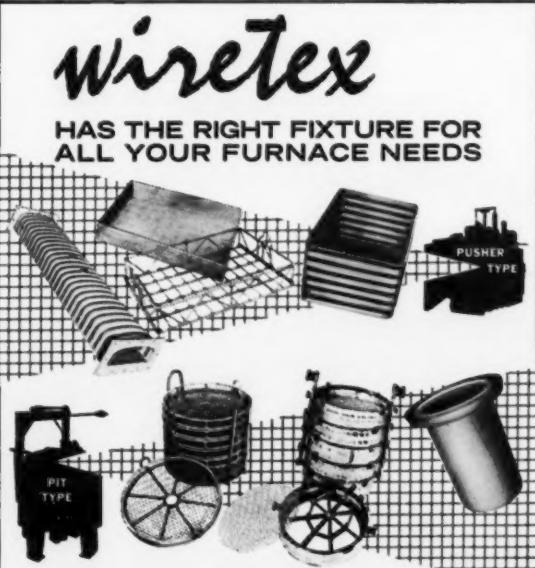
would never have agreed to giving a man one-sixth of the pay he would have earned. It may be that these employees are entitled to a small payment under the two-week National Guard service clause of the contract, but that's all."

"The contract doesn't contain any qualifications as to the length of the enlistment," answered the union's international representative. "If you think it should, bring it up at the next negotiations. Meanwhile you have to pay these men."

### What Would YOU Do?

**THE AWARD.** The arbitrator said: "I am not disposed to correct the parties' collective bargaining agreement by making allowances for unanticipated changes. There is no provision for reopening of this section and modification of the contract by the arbitrator is expressly forbidden. The arbitrator is therefore powerless to find other than that the 160 hours of pay shall not be withheld."

**CAUTION.** The award in this case is not necessarily an indication of how arbitrators might rule in apparently similar disputes. Each case is decided on the basis of the particular history, contract, testimony and other facts involved. Some of these essential details may have been omitted in condensing the original arbitration for brief presentation. • • •



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**Wiretex** mfg. co., 16 Mason Street, Bridgeport 3, Conn.

For further information circle No. 88

FEBRUARY-MARCH, 1961



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### Special - CARBONITRIDER

ONE only "Dow" Mod. B 1300<sup>2</sup> capacity, Hearth 30" x 48" with Endo. Atm. Generator with alloy trays & controls Condition — Excellent & Complete Immediate Delivery

#### STEAM-HOMO LEEDS & NORTHRUP

Model 9522-26-10-S Protective Atmos. Suitable for any Tempering 22" x 26" Working Chamber, Max. Temp. — 1250°F

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Hevi-Duty — 24" x 48" — 1850°F — electric  
Hevi-Duty — 12" x 24" — 1850°F — electric  
American Gas — 24" x 48" — 1750°F — Gas fired

#### DRAW-RECIRCULATING

Despatch — 24" W x 36" deep x 18" H — electric & Gas — 1200°F

Lindberg — 2530-EH — 1250°F — electric — 220 or 440V

#### ATMOSPHERE GENERATORS

Lindberg — 500 CFH — Endothermic — Gas fired  
G.E. — 2000 CFH — Endo. — Gas fired  
G.E. — 500, 1500 and 2000 CFH — Exothermic  
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**Engineering Co.**

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For further information circle No. 89



## MANUFACTURERS' LITERATURE

*Continued from page 32*

In tests, after being in service as long as five years, these units are said to have maintained 99.985% dissociation leaving only 150 parts per million of residual ammonia. Dewpoints of -60 F. or lower were recorded. Catalog Section 25 includes a flow diagram and details unusual construction features such as twin Inconel catalyst chambers and reaction coil, and dual-purpose heat exchangers which preheat incoming ammonia vapor while cooling the dissociated gas. Capacities available are 300, 500, 700, and 1000 C. F. H.

*For further information circle No. 15*

**Newly Perfected Metal Powders** produced by atomization in the Research and Development Labora-

tories of the Federal Mogul Division of Federal-Mogul-Bower Bearings, Inc., are designed for wide uses in a variety of industrial and experimental applications. Many of these superior quality powders are used in brazing alloys, filters, dispersion hardening, fuel cells, thermonuclear devices, electronic and semi-conductors, and many other powder metallurgy applications. The entire story is available in a four page color brochure available from Federal-Mogul-Bower Bearings, Inc.

*For further information circle No. 13*

A new brochure entitled "Modern Thickness Testing" has been published by Twin City Testing Corp. Included as part of this study is an informative description of the various non-destructive methods currently employed for measuring the thicknesses of organic and non-

magnetic metal coatings (including phosphate) on iron and steel. The advantages and limitations of each method are thoroughly discussed in light of thickness measuring instruments now available. Copies of this brochure as well as illustrated literature covering Twin City's new Type ES Permascope Thickness Tester can be obtained, without charge.

*For further information circle No. 14*

**Small Capacity Hi-Lo Temperature Chambers** are described in a new four page folder available from Cincinnati Sub-Zero Products. One to ten cubic foot units are especially designed for lab and job shop applications where temperatures from -150 to +300 F. are required. Space saving, low cost mechanical units are pictured, along with accessories and special controls.

*For further information circle No. 22*

**Fluidized Bed Heat Treating Furnaces and Quench Baths** designates a four page bulletin which describes the fluidized bed heat treating equipment developed by General Electric for annealing, normalizing, solutionizing, aging, hardening, quenching, and isothermal transforming. The publication explains how the process works to permit up to 85% reduction in heating time. Charts show comparative heating and quenching rates for steel.

*For further information circle No. 18*

A full color brochure describing the company's new continuous **Controlled Atmosphere Furnace** for heat treating cold finished bars has been published by Jones & Laughlin Steel Corporation. The four page brochure explains how this furnace—and the exclusive Electreat process—provide a full range of heat treating processes for uses of cold finished bars.

*For further information circle No. 16*

A booklet entitled **Keep Operating Costs Down When Temperatures Go Up**, describing special heavy duty,

**AUTOMOTION** best describes AGF's unique automatic heat treating furnaces . . . both Reciprocating Hearth and Rotary Retort . . . employing the "Work in Motion" principle that assures uniformity of case and hardening.

AGF's **AUTOMOTION** Furnaces operate wholly automatically and continuously, and are easily placed in any continuous or intermittent production line.

Send for catalogs and details of models to meet your specific needs

AMERICAN GAS FURNACE CO. 808 LAFAYETTE STREET, ELIZABETH, N.J.

*For further information circle No. 90*

shock resistant, alloy quenching baskets, along with details of the characteristics of the alloy from which they are fabricated, has been released by Huntington Alloy Products Division of International Nickel Company. According to the booklet, the alloy is adaptable to many products used in heat treating and special fabrications can be formed and welded to special designs. Also described are the material's unusual characteristics in high temperature heat treating atmospheres.

For further information circle No. 27

A new 14 page illustrated Technical Bulletin on **Nitriding Processes** has been prepared by Armour Industrial Chemical Company. The bulletin covers the case hardening of metals with anhydrous ammonia atmospheres in various nitriding applications. Included is a brief history of nitriding, and information on nitriding equipment and techniques. Technical data in handy tabular and chart form are also presented in the bulletin.

For further information circle No. 32

**Temperature Control Bulletin 109** published by Burling Instrument Company, Chatham, New Jersey, gives a full description of indicating differential expansion type temperature control. This Model LD-1S is for electric operation and includes a snap-action Micro switch. Indication is with independent dial thermometer incorporated in tube assembly. The bulletin includes pictures, description of operation, and table of standard ranges, tube sizes, and performance.

For further information circle No. 33

**Steel Castings Handbook**, third edition, has been released by the Steel Founders' Society of America. The edition has been completely

rewritten and incorporates new data developed through research by the Society and other agencies in the United States and abroad. The present Handbook has been written entirely from the viewpoint of the designer and user of steel castings and constitutes the most comprehensive source of data on the proper design, selection and heat treatment of steel castings in the world today. Beneficial effects of heat treatment are identified throughout the book. In addition, a separate chapter deals with the specific procedures to achieve best results in the treatment of steel castings. Design of steel

castings is given particular attention in a 76 page chapter which incorporates several new approaches along with selected points from previous editions. This chapter would be especially helpful to design engineers seeking to either improve or develop more efficient designs in structures and equipment. Cost of the book is nominal with sales price established to cover only printing and mailing costs. A folder outlining the chapter contents and including an order blank is available from the Steel Founders' Society of America.

For further information circle No. 31

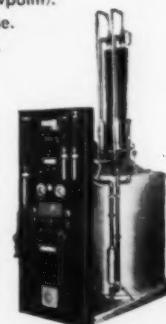
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- **important NEW aids to quality control**
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- Immediate and constant response.
- Precise and dependable control.
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- Specially trained operators not required.

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- Complete reversibility and self-cleaning of catalyst beds.
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- Dual Catalyst chambers . . . complete cracking.
- Triple cooling effect prevents reverse action.
- Compact, easily installed "packaged" unit.

U.S. Patent No. 2,802,725 (Koppel)



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For further information circle No. 91



High alloy such as RA-330, Hastelloy and Inconel—for the heat treating industries . . . a plant with over 50 years experience as fabricators, and grey iron castings. Illustrated above is Venturi-High Temperature Alloy.

Alloy muffle . . . example of one type fabrication job.



Corrugated baskets.



Pickling rocks.



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For further information circle No. 92

## NEWS TO HEAT TREATERS

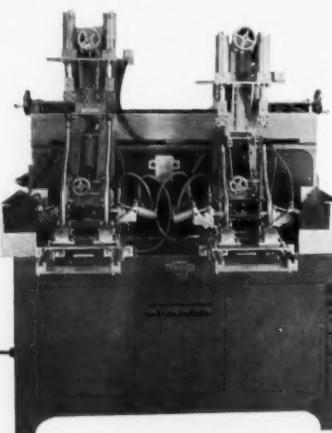
*Continued from page 30*

The new furnace plus enlarged quenching area added to Pittsburgh Commercial's constantly growing facilities make it one of the nation's largest heat treaters.

*For further information circle No. 4*

### IHC Solves Bicycle Brazing Problem

The difficult problem of using one small installation to braze the fourth and final joint of 11 varieties of bicycle frames has been solved by engineers of Induction Heating Corp., Brooklyn, N. Y.



This is how IHC's electrical and mechanical engineers solved what had been a time consuming and expensive process.

To cover the variety of shapes and sizes, two sets of work coils were installed at the induction heating work station. A work handling machine, consisting of clamps operated by pneumatic cylinders, positions and holds two harp joints simultaneously for silver brazing. Two of these machines are mounted at two stations and the fixture, therefore, accommodates four frames. While two joints in one machine are heating, the operator loads frames into the other machine on stand-by, avoiding waiting time.

*For further information circle No. 7*

## Rust Preventative Oil

Patclen Chemical has developed a series of water displacing rust preventatives for use in metalworking and finishing shops as a rust preventative for use between operations. They are especially applicable in preventing rusting after deburring, barrel cleaning and burnishing. Three grades are being marketed, Patclen #404, which leaves a light monomolecular film; #430, which leaves a soft non-drying film; #431, which leaves a hard waxy film.

The wet work is immersed in the proper Patclen Water Displacing Rust Preventative. The water is displaced and a film is deposited on the work.

The #404 Water Displacer can be used, after plating, to prevent staining and spotting out. In this case the rust preventive film is removed in a vapor degreaser.

The preventives are sold in 55 gallon nonreturnable drums.

*For further information circle No. 34*

## Strength Sealing Compound

A new sealing compound is now available through Devcon Corporation, Danvers, Massachusetts. This material is permanently flexible, waterproof, and has tremendous adhesion—a pull of 1500 lb. is required to separate two wooden blocks, one inch square.

This new product, Devcon Tub and Tile Sealer, was developed for plumbing applications but is proving of interest to general industry for caulking and sealing around tanks, windows, air ducts, water lines, electrical boxes, wash basins, and for many other sealing applications. It is quick setting, white, non-yellowing, and easy to use.

*For further information circle No. 29*

## Coating Development

North American Aviation, Inc., has licensed Seaporcel Metals, Inc., to use a newly developed coating,

Cermet N16, and a related coating process for protecting metals subject to extraordinary temperature extremes.

The agreement covers a new technical advance for industry previously handicapped in using various metals exposed to temperature extremes, such as missile launching pads, certain jet aircraft components, heavy duty mufflers, and diesel engine parts.

Cermet N16 was developed by North American Aviation's Columbus Division to fully protect a variety of metals used in industry in operational circumstances under temperatures ranging from -65 through 2000 F. It provides substantially greater protection than is possible with other materials and processes, and at a considerably lower cost.

The new coating is adaptable to such metals as low carbon steel, tool steel, cast steel, enameling iron, cast iron and such exotic metals as molybdenum, columbium, and tungsten.

For further information circle No. 28

### Improved Thermocouples

Improved thermocouples for precision heat treating that provide a new, high degree of accuracy in recording maximum as well as low temperatures used in heat treating have been announced by Electric Arc, Inc.

The thermocouples were developed primarily for use with the com-

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HEAT RESISTING  
ALLOYS  
FROM STOCK

Stock List and Literature Available

**HOLLED ALLOYS, INC.**   
Heat and Corrosion Resistant Alloy Specialists  
5309 CONCORD AVE. DETROIT 11, MICH.  
330 WILLIAM ST. SOUTH RIVER, N. J.

For further information circle No. 87

pany's portable Smith-Dolan units for pre-heating and stress relieving in field and shop welding. Made with matched and graded 14 gauge wire, they are processed and tested for accuracy to 1900 F. Positive

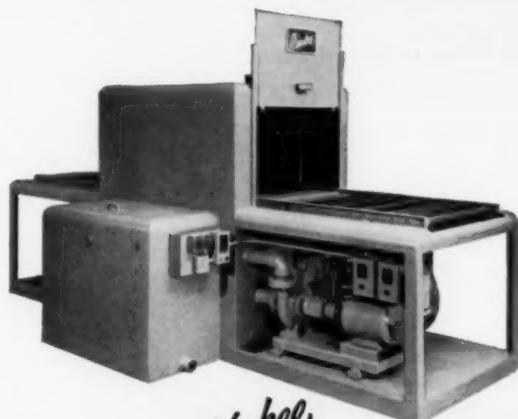
junction with the work is provided by stainless steel tips enclosing the thermocouple heads. There is insulation with glass sleeving for induction heating and ceramic spline beads for resistance heating.

For further information circle No. 48

### Dual Purpose Machine

Tensile, compression, and guided bend tests can all be made on a single machine just announced by Steel City Testing Machines, Inc., Detroit, Michigan. Motor and hydraulic power unit are located within the base of the tester, and the controls are conveniently mounted on the front. Model TE-10-AS, shown here, has a capacity of 10,000 pounds, and is equipped with two gages to register the load applied in two ranges. Similar ma-

Continued on next page



There's a standard  **WASHER**  
TO MATCH YOUR CARBONITRIDER OR CARBURIZER!

Whatever the size of your carbonitriders or carburizers, the new Waukeez Washer has a standard size to match it. Size range: 24 x 36 x 18 — 24 x 48 x 24 — 30 x 48 x 24 — 36 x 48 x 24.

**COMPLETE — NO "EXTRAS"** — Waukeez parts washers come to you complete, ready to locate, connect to utilities, and begin operation. No "extras" to buy and install. Pumps, burners, controls are designed as integral parts of the Waukeez Washer. You use your present furnace work-baskets, too.

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Waukeez-washed parts are free of cutting and quenching oils, mean clean furnace atmospheres, therefore predictable case depths and cleaner, brighter work.

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For further information circle No. 93



....tough on retorts

## 2100° F VACUUM BRAZING

demands  
Exacting  
Fabrication



This 8-foot-high bell retort fabricated of  $\frac{1}{4}$ -in. RA 330 stainless by Alloy Engineering is used for equalized vacuum brazing in an electric refractory furnace. Designed for 2100° service at a 4 micron/1000 micron equalized vacuum, the retort is subject to cyclic thermal stresses reflected by a 1-in. increase in diameter at operating temperature.

The upper cylinder, 4 feet in diameter, tapers to  $6\frac{1}{2}$  feet at the bell base where it is joined to the  $1\frac{3}{4}$ -in. mild-steel base ring grooved top and bottom for O-ring vacuum seals.

Alloy's experience with performance factors of high temperature equipment enables it to assist in engineering with recommendations as to construction, type and gauge of material. Careful fabrication, preparation and welding enables Alloy to produce retorts, muffles, and fixtures for trouble-free high-temperature service.

Rely on Alloy's experience and facilities to help solve your heat treating problems.

Write today!

THE **ALLOY** ENGINEERING COMPANY  
70 Sheldon Road / Berea, Ohio

For further information circle No. 94

## NEWS TO HEAT TREATERS

chines having other capacities can be provided.

Guided bend testing, which consists of bending butt welded samples that are originally flat into U-shapes at the welds, is performed in the compression testing area of the ma-



continuous carburizing furnace  
BASKET



Designed by Alloy or fabricated to  
your specs.; trays and fixtures  
for economical service.

2100° hydrogen atmosphere  
sintering MUFFLE



Custom engineered and fabricated  
to your service needs.

chine. The fixture, which conforms with AWS, ASME, ASTM, and United States Government specifications, consists of a punch secured to the underside of the upper platen and a die mounted on the middle platen by means of two locating pins. Fixtures are quickly interchangeable to permit testing butt-welded specimens of various thicknesses.

When used as a tensile testing machine, the lower jaw holder is placed in one of the three sets of slots, to suit the specimen length. A variety of jaw inserts are available to hold specimens up to  $\frac{1}{2}$  in. thick by  $1\frac{1}{2}$  in. wide, or  $\frac{3}{4}$  in. diameter. The machine shown will accommodate specimens up to eight in. long. Other models will handle longer specimens.

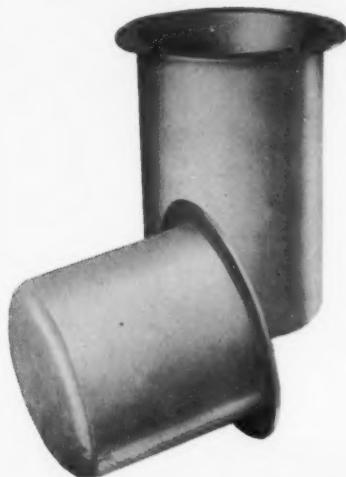
For further information circle No. 51

## Service Life Boosted 75%

Substitution of equipment made of Inconel for previously used fixtures made of plate and alloy has boosted plate pot life by more than

75% for MacInnes Steel Treating Company, Erie, Pennsylvania.

The new Inconel pots carry loads of up to 150 pounds, are subjected to temperatures that reach as high as 1850 F. for short periods and are used in a Holden fuel fired furnace. The pots were made by Wiretex Manufacturing Company, Inc., Bridgeport, Conn., and measure 18 by 24 in. They have been in regular use for one year.



Contract steel treaters, MacInnes uses plate pots for salt bath hardening of screw machine parts, gears, shafts and rings of all carburizing grades. Salts reach temperatures of from 1450 to 1750 F. during an operation that may last from one half hour to four hours. Pots are in continuous use for from eight to 10 hours.

Prior to use of the present equipment, MacInnes had been getting a maximum service life of three months from its plate pots. The first Wiretex Inconel pot installed a year ago is still in regular use.

For further information circle No. 45

#### Reference Junction

A 3000 series elevated temperature thermocouple reference junction designated Model TRJ-3006 is being introduced by Temptron, Inc.

The low cost, compact, portable unit, developed for in-plant and laboratory use, is a basically stable

device designed around a simple, reliable, on-off type temperature

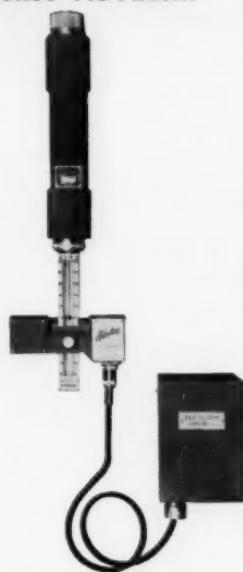


control system which operates on a small temperature differential. The cycling temperature effect is damped by a heat sink until the temperature variation is typically less than  $-1/6$  F.

The unit's error free screw tie point terminals allow direct thermocouple contact, thus eliminating errors normally present due to temperature gradients across the connectors.

For further information circle No. 52

#### Waukee Flo-Alarm



Protection against hazard due to failure of flow of gas to a process or heat treating furnace is provided by the new Waukee Flo-Alarm.

Continued on page 42



The Niagara Aero Heat Exchanger transfers the heat to atmospheric air by evaporative cooling. It extends your quenching capacity without using extra water. It pays for itself with water savings.

You can cool and hold accurately

## You Get Better Results IN HEAT TREATING!

- Use the NIAGARA AERO HEAT EXCHANGER to control the temperature of your quench bath and you remove the heat *at its rate of input*, always quenching at the exact temperature that will give your product the best physical properties.

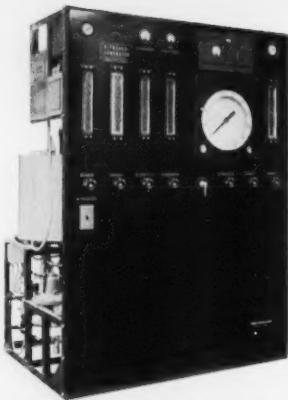
the temperature of all fluids, gases, air, water, oils, solutions, chemicals for processes and coolants for mechanical and electrical equipment. You get closed system cooling, free from dirt and scale.

Write for Bulletins 120, 124, 132

## NIAGARA BLOWER COMPANY

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District Engineers in Principal Cities of U. S. and Canada  
For further information circle No. 95

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THE GAS  
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ATMOSPHERES  
FOR METAL  
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... provides the most economical and efficient method for the production of pure nitrogen—completely free of oxygen—with a hydrogen content precisely controlled at any desired percentage between 0.5% and 25%. Gas mixtures are supplied at a fraction of cylinder supply cost. • The Nitroneal Generator is automatic except for startup, with no need for operating personnel. The unit performs instantly, efficiently anywhere in the range of from 25% to 100% of rated capacity. Installation requires only a 110 volt line, water, air, ammonia lines and drain facilities. . . . The catalyst lasts indefinitely—minimum maintenance costs.

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INDUSTRIAL EQUIPMENT  
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- Simple to operate, fast, precise

Complete information in  
Dewpointer bulletin No. 2051



**ALNOR INSTRUMENT CO.**

Division of  
Illinois Testing Laboratories, Inc.

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For further information circle No. 97

## HEAT TREATING ROHR'S • • •

*Concluded from page 15*

They further discovered that A-286—in the as received solution heat treated condition—could be adequately precipitation hardened if heated to  $1325 \pm 15$  F. for 16 hours.

Following either of the above treatments, air cooling was inaugurated to prevent the distortion of sheet metal components. Heavier parts had been oil and water quenched with equally good results.

All cooled or quenched parts have some discoloration, which indicates that slight surface oxidation has occurred. This discoloration was removed with a pickling solution, primarily for the sake of appearances, after which it was virtually impossible to detect a loss of metal from the A-286 components.

Physical tests have consistently shown that the heat treated parts have 140,000 p.s.i. ultimate tensile strength and 110,000 p.s.i. yield strength at room temperature; 120,000 p.s.i. ultimate tensile strength and 90,000 p.s.i. yield strength at 1000 F.

Since the above values are in approximate conformity with maximums cited in manufacturers' literature, it appears safe to say that Rohr has gained a definite production cost advantage without a sacrifice of quality by not using exotic equipment in at least one notable instance. • • •

## PROPERTIES • • •

*Concluded from page 14*

condition and having a hardness of about Rc 45 would be machined to a desired shape. The machined part would then be heat treated identically to a high speed steel blank. Parts would be preheated to about 1550 F., then austenitized at 2300 F. for a short time, depending on the cross section of the tool, then finally quenched in oil. The hardened tool is then drawn at 950-1050 F. for one hour. The quenched hardness is about Rc 72. After tempering for one hour at 1000 F. the hardness would be 70.5-71.5 Rc. Figure 4. In this condition, the tool would be put into use. Figure 5 shows tool life curves of Ferro-Tic "J" versus several other tool materials. This curve was established by Metcut Research Associates of Cincinnati, Ohio. On the work material in these experiments (A1SI 4147 at 300 BHN) significantly superior tool lives were found with Grade "J" versus high speed steels. For example, at 100 sfm the life of an M-2 high speed steel tool was about 17 minutes; the life of a T-15 tool was about 19 minutes. By extrapolation, the tool life of a Ferro-Tic "J" was about 90 minutes or better. This was an improvement of 400% or more.

### Conclusion

The steel-bonded carbides are still a relatively new family of engineering materials. Their chief assets are

the combination of fabricability of steels with the wear resistance approaching that of cemented tungsten carbides.

At the present, only four grades are available: two austenitic stainless steel-bonded grades offering machinability and corrosion, oxidation and wear resistance; two martensitic steel-bonded materials offering machinability, heat treatability and extreme wear resistance in the hardened condition.

The presently available grades of these materials are only the first of a large group of possible composites based on steels.

#### REFERENCES

1. Ellis, John L., A Machinable, Heat Treatable and Weldable Cemented Carbide for Tooling Purposes. Paper presented before the 25th Anniversary Meeting of the ASTE, March 1957.
2. Epner, Martin and Gregory, Eric, Some Properties and Metallography of Steel Bonded Titanium Carbide. *AIME Transactions* 1960, vol. 218, pp. 117-121.
3. Epner, Martin and Gregory, Eric, Carbides of the Elements of the Fifth Group of the Periodic Table Bonded with Steel. *Planseeberichte für Pulvermetallurgie*, December 1959.
4. Ellis, John L., Gregory, Eric and Epner, Martin, Heat Treatable Steel-Bonded Carbides: New Construction for Tools and Wear Resistant Components. 16th Annual Meeting of the MPI, April 1960. • • •

#### AGF AUTOMATION • • •

concluded from page 18

to process on a continuous basis small production runs of different parts ranging from stainless steel rivets to nickel and brass nails, rivets, or welding tips as shown in the illustration.

A leading commercial heat treater in the metropolitan New York area, Fred Heinzelman and Sons, in their new Carlstadt, New Jersey plant, has installed a new 800 lb. per hour capacity double hearth shaker hearth in addition to an existing 400 lb. per hour unit.

The new automation furnace permits Heinzelman to process both small and large lots of the widest variety of parts on a production basis without any modifications to the furnace or lost production time. • • •

#### NEW HEADQUARTERS METAL TREATING INSTITUTE

National Trade Association of the Commercial Heat Treating Industry



Box 448

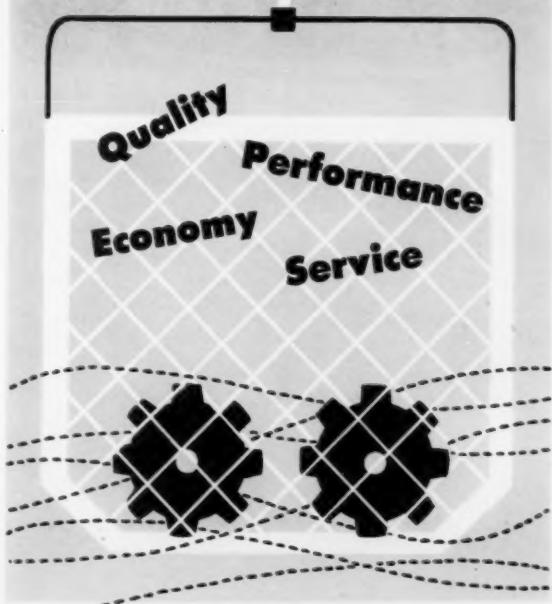
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39 Years of Service to the Heat Treating

and Metal Finishing Industry

For further information circle No. 98

## NEWS TO HEAT TREATERS

Continued from page 39

The Flo-Alarm operates in conjunction with a standard Waukeez Flo-Meter and is easily adapted to any present Waukeez unit of this type. The Flo-Alarm utilizes the photo-electric principle.

Should the flow drop below a predetermined point, which is easily adjusted, the Flo-Meter indicator interrupts a light beam which is focused on the photo-electric cell

and the Flo-Alarm sounds a warning or operates a purge system.

The Flo-Alarm can be adapted to all meters ranging from 0-10 CFH thru 0-30,000 CFH. A standard Flo-Alarm can be used for low or high flow warning, and a combination of two standard units can be used for low and high flow warning if desired. The relay contacts contained in the Flo-Alarm control, handle 10 amperes at 110 volts.

For further information circle No. 39

**HEAT AND CORROSION RESISTANT**

**CASTINGS & FABRICATIONS**

**LINDBERG TRAY and BASKET**

This combination light-weight cast tray and wire mesh basket is designed for use with the Lindberg carbonitriding furnace. The Tray, weighing only 65 pounds, incorporates all the General Alloys features — such as cored intersections, full radii on all corners and edges, separate shoe arrangement, 60 Ni-15 Cr. alloy — which provide maximum resistance to atmosphere and quenching. The Basket utilizes the inherent advantages of combination cast and fabricated alloy. It is made of wire mesh with a cast top ring, which minimizes distortion. Baskets can be supplied in varying heights and openings and frames, to suit any load condition. Both tray and baskets can be delivered from stock.



**GENERAL ALLOYS COMPANY**  
FABRICATED ALLOY DIVISION  
390 WEST FIRST STREET • BOSTON 27, MASSACHUSETTS

For further information circle No. 99

## Lens Cleaning Station

A new lens cleaning station that provides cleaning and fogproofing of lenses in a single application is being marketed by Albert W. Pendegast Safety Equipment Company.



The unit consists of a heavy duty metal wall cabinet which contains two one pint bottles of liquid, two spray pumps and one box of 240 tissues. Bottles are of unbreakable plastic.

For further information circle No. 44

## Sunbeam Wide Range

The accompanying photograph shows the new Sunbeam wide range furnace being introduced by Sun-



beam Equipment Corporation, Meadville, Pennsylvania.

A 300 F. to 2400 F. temperature range is the principal feature of this unit. It can be used for practi-

Continued on page 44

METAL TREATING

ANOTHER ROHR FIRST.  
ANOTHER PACIFIC FIRST...  
in creating new dimensions  
for steel honeycomb  
structures.



## CAR-BOTTOM FURNACE\*\* [DESIGNED] AND

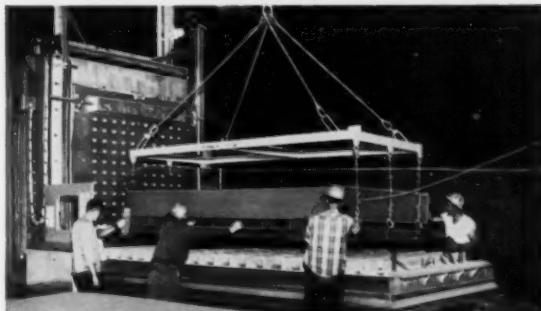
BUILT BY PACIFIC, HELPS PRODUCE WORLD'S  
LARGEST STAINLESS STEEL HONEYCOMB SANDWICH PANEL\*!

Proving that honeycomb can be made in panels much larger than previously thought possible, Rohr Aircraft has completed by far the largest stainless steel honeycomb sandwich ever produced. The big panel measures 6 by 12 feet! This means airframe designers will be able to employ honeycomb in many larger configurations and not be hampered, for all practical purposes, by size limitations.

Production was made possible by Pacific's specially designed car-bottom high-temperature, atmosphere-tight brazing furnace... the largest of its kind. Inside working dimensions of the Pacific furnace are 7 by 7 by 16 feet... ample room for even larger panels! It fully meets all the exacting requirements for honeycomb brazing and heat treating, including extreme uniformity of temperature. All-welded retorts may be used with the furnace, and provision is made for vacuum and atmosphere lines from retort to external components.

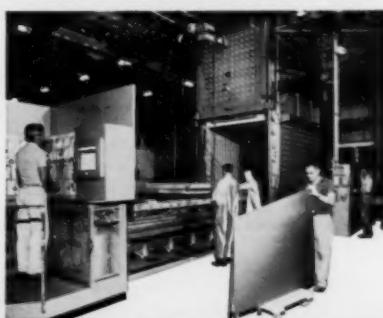
Also used for brazing panels for the B-58 Hustler, the big furnace is but one of many special furnaces that Pacific has designed and built to provide faster, more efficient production of stainless steel honeycomb. If your requirements call for a special furnace such as this or a standard design furnace, Pacific can be of service to you. For specific information call or write Pacific Scientific Company today!

- Panel dimensions — 6' x 12' x 1"
- Square cell core and skin — AM-350 SS
- Bar stock — AM-355
- Brazing alloy — silver-copper-lithium
- Brazing temperature 1650°F.
- Atmosphere-argon



### DESIGN FEATURES FOR MORE EFFICIENT, MORE ECONOMICAL OPERATION:

- Cam profiled ways insure smooth action, gas-tight door
- Air operated door
- Alley capped car piers for flat working surface for retort
- Multiple zone control
- Heating elements on all side walls, door and car hearth
- Temperatures from 900°F. to 2200°F.
- Uses any protective atmosphere including hydrogen



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For further information circle No. 100

FEBRUARY-MARCH, 1961

## NEWS TO HEAT TREATERS

Continued from page 42

cally every heat treating process including annealing, pack carburizing, hardening, normalizing, preheating, stress relieving and tempering. Both ferrous and non-ferrous alloys may be heat treated under accurate temperature control. Burners have a 95% turn down ratio for close temperature control and heat distribution.

The units are available for gas fired heating in three standard sizes with work areas ranging from 4 in. by 8 in. by 12 in. to 9 in. by 15 in. by 24 in.

For further information circle No. 47

## Leeds & Northrup Acquires English Company

Leeds & Northrup Company, Philadelphia, has acquired all outstanding shares it had not previously owned of Integra, Leeds & Northrup Ltd., of Birmingham, England, and this subsidiary has been renamed Leeds & Northrup, Ltd. The purchase price was not revealed. A substantial additional capital investment is involved, to expedite a program for improvement of plant and facilities.

Integra, Leeds & Northrup was formed in 1953 when Leeds & Northrup purchased a substantial

interest in what had been The Integra Co., Ltd., which had been one of the Leeds & Northrup sales agents for many years. The parent company is a large manufacturer of electronic controls, measuring instruments and heat treating furnaces, employing about 3,000 persons. Leeds & Northrup, Ltd., makes many of the same products as the parent company. The firm employs about 250 full time workers.

For further information circle No. 71

## Vacuum Tempering Furnace

A vacuum purge controlled atmosphere tempering furnace with a work space 10 in. diameter and 14 in. deep, operating pressure to 50 microns Hg, input of 9 kw, and a maximum operating temperature of 1500 F. is available from Ipsen Industries, Inc.

**PSC**  
*fabricated alloy*

**FURNACE TUBES & RETORTS**

Save You Money

And PSC furnace tubes, for example, often double the service life of cast tubes. As one of the leading suppliers of fabricated heat-treat units, PSC also furnishes boxes, baskets, pots, trays; any size, style.

Save with PSC All-Sheet Equipment

**THE PRESSED STEEL CO.**  
Wilkes-Barre, Pa.

For further information circle No. 72



This unit rounds out a complete line of vacuum heat treating equipment by the manufacturer, permitting treatments from 200 F. to 4000 F. in vacuum or atmosphere. The new unit, series VVD-10x14, is designed primarily to bright temper work previously heat treated in the VVFC-10x14 so work does not have to be removed from the basket.

Minimum floor space is required for the VVD-10x14. The furnace and vacuum system are housed in a single unit, having a floor area of 42 in. by 48 in. The separate control panel with strip chart temperature recorder is 6 ft. high and occupies an area 24 in. by 13 in.

The unit works with any gas that is reducing, oxidizing, or inert. Internal water cooling coils and directional baffles permit rapid cooling of the circulating gas. The unit can be safely operated under partial pressures or full pressure with such gases as hydrogen, endothermic, cracked ammonia, or rich endothermic.

Operating advantages of the vacuum furnace include the prevention of surface oxidation, the ability to produce bright work, the prevention of surface contamination, and the prevention of gas absorption after vacuum heat treating.

For further information circle No. 70

### Magnaflux Purchases Metal Control Labs

Magnaflux Corporation, Chicago, a wholly owned subsidiary of General Mills, has acquired Metal Control Laboratories, Los Angeles, to effect a complete complement of integrated nondestructive, metallurgical, and physical testing facilities and skills.

R. A. Wilson, Magnaflux president and vice president of General Mills, in making the announcement, said that Metal Control Laboratories will be operated as a part of the Magnaflux organization, working closely with the present Magnaflux Materials Testing Laboratories at Los Angeles and Van Nuys, California. Magnaflux has pioneered and is a recognized leader in non-destructive test methods, materials and equipment. Metal Control Laboratories has had its major growth in metallurgical, chemical and mechanical testing.

These combined capabilities are calculated to enable Magnaflux to render a wider range of materials development and evaluation services to meet the broader needs of the missile and aircraft, weld, forge and foundry, petroleum, automotive, and general machining industries on the West Coast.

For further information circle No. 40

## Make SHALLOW Measurements ACCURATELY



Wilson Rockwell Superficial Hardness Tester

• Wilson Rockwell Superficial hardness testers are used to measure surface hardness, coatings, thin metal or thin hard cases. The hardness test is based on a penetration of less than .005", and Wilson Superficial testers have the precision and ease of operation to give accurate readings every time.

**Accurate**—Precision-built for consistently correct results. Knife-edge bearings provide near-frictionless operation.

**Easy to operate**—Controls conveniently grouped—oil dash-pot system provides smooth load application.

**Long lasting**—Simple design, rugged construction make Wilson Superficial testers as durable as a machine tool.

**Complete line available**—Wilson Rockwell hardness testers and accessories are available in a wide variety for every hardness testing function.



**Wilson "Brake" Diamond Penetrators**  
Each diamond is cut to an exact shape. A comparator check and microscopic inspection of each diamond assure perfect readings every time.

**Write for details**—Ask for Catalog RT-58. It gives complete information on the Superficial tester as well as on the full line of Wilson Rockwell hardness testers.



## WILSON "ROCKWELL" HARDNESS TESTERS

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Whatever the part—large, small, odd shaped—there is a Stanwood basket, tray, fixture or other container to handle it through heat treating and quenching with maximum efficiency. Stanwood's broad experience can cut costs for you.

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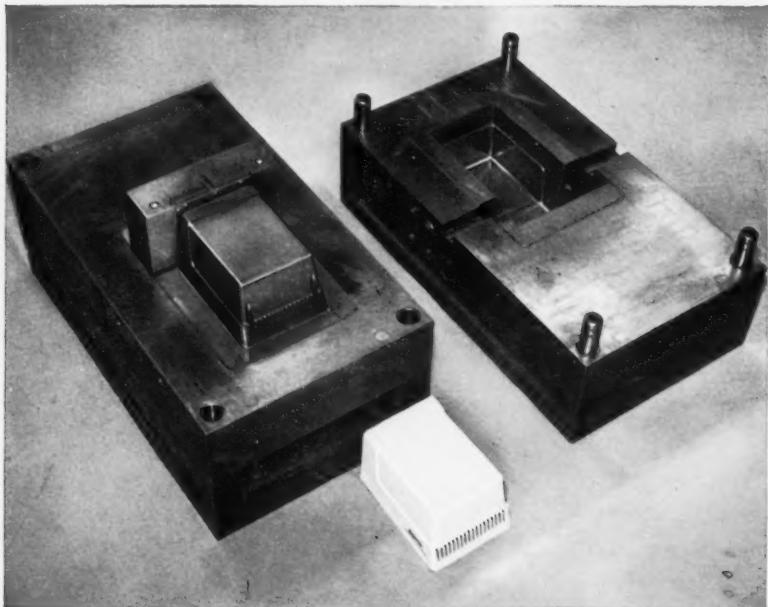


# Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Sales: Bethlehem Steel Export Corporation



## LUSTRE-DIE does smooth job in molding can-opener housing

Bethlehem Lustre-Die tool steel, which is furnished pre-heat-treated in bars, recently turned out a top-quality molding of high-impact polystyrene at Cepco Plastics Co., St. Louis. The plastic-injection mold, made by Lambert Engineering Co., produced a sturdy, attractive can-opener housing for Swing-A-Way Manufacturing Company.

Here are the reasons why Lustre-Die made such hit: 1. It saved time, because no heat-treatment was required. 2. It was easier to machine than other pre-hardened grades which were previously used. 3. It polished beautifully, and imparted a high sheen to the finished part.

An electric-furnace steel with a well-

balanced basic analysis, Lustre-Die is ideal for working with plastic because it takes a glossy polish. This tool steel also has something extra: a special alloy fortification which further increases its depth of hardenability and enhances its mechanical properties. It is heat-treated by oil-quenching and tempering at the mill, and is furnished ready for machining and polishing. Careful manufacture and quality control insure its freedom from porosity.

You can take our word for it—Lustre-Die is just what you need for a good plastic-molding job. For full details, and prompt delivery, get in touch with your Bethlehem tool steel distributor.

### BETHLEHEM TOOL STEEL ENGINEER SAYS: *Straighten tools while they are hot*

Though seldom recognized or appreciated, straightening is an essential part of the quench and temper hardening operation on long, slender tools. The correction of warpage which occurs either in heating tools to the quenching temperature, or from stresses generated in the quench, must be done during heat-treatment. Only minor straightening can be done on hardened tools at room temperature after the hardening operation is complete.

For example, the major straightening on a long rectangular shear blade must be done during quenching. The heat-treater learns by experience at what point the quench can be interrupted so that straightening can be performed. This point varies with the grade of tool steel, and the size and shape of the shear blade. Straightening usually is performed by bending the tool slightly on a press (so-called gag straightening).

Small amounts of additional straightening can be accomplished when the tool is at the tempering temperature. Or, if necessary, this can be done by reheating to a point just below the final tempering temperature.

Minor mechanical adjustments in the final assembly of tools and components are often made by peening the concave surfaces with a hand hammer. This should be done cautiously to avoid spalling or cracking. However, it is preferable to straightening by cold-bending.



### New Booklet on Oil- and Air-Hardening Grades

We have a new illustrated booklet on oil- and air-hardening tool steels. It presents essential data about the BTR, Air-4, Lehigh H, and A-H5 grades. For your copy, write to Publications Dept., Bethlehem Steel Co., Bethlehem, Pa. Ask for Booklet No. 532.



## GET THE FACTS!

For the complete story of Benedict-Miller's high-speed salt bath and operational details, write for **AJAX SALT BATH TIPS & TRENDS**, Vol. 12, No. 2.

**This commercial heat treaters' high-speed Ajax salt bath installation has meant**

# Uniform...Decarb-free...Straighter Work HARDENED 2 TO 3 TIMES FASTER!

When Benedict-Miller Inc., well-known commercial heat treaters of Lyndhurst, N. J. installed their Ajax high-speed salt bath furnace they expected a lot in the way of better, lower cost results—and got even more! Here, after 3 years of constant use, is the way it stacks up:

### WORK HANDLED IN 50% - 75% LESS TIME!

Regardless of size, shape or type of high-speed work, loads are handled in from 2½ to 4 hours as compared to 7 or 8 hours previously.

### CHEAPER FIXTURES . . . . FASTER FIXTURING

Costly special alloy trays that necessitated painstaking fixturing of the work have been replaced with simple, easily-loaded carbon steel fixtures.

### OUTSTANDING RESULTS ON T-TYPE COBALT STEELS . . . .

Hardness of  $R_c$  66-68 is consistently obtained on critical cobalt steels such as  $T_2$ ,  $T_4$ ,  $T_5$  and  $T_6$ . Decarburization is not a factor. Finish grinding is seldom needed. (Previously a minimum of .010" had to be allowed for grind-

ing even though protective coatings were used on the work to reduce decarburization.)

### PLUS THESE ADDITIONAL ADVANTAGES!

The same Ajax furnace and the same salt operate at any required temperature between 1750° and 2350°F. . . .

One daily rectification maintains bath neutrality. . . .

Partial hardening can now be done as needed. Because salt bath heating is so much faster than other methods, there is no danger of oversoaking light sections of pieces of varied thickness . . .

. . . And furnace maintenance has been lower than their best expectations.



# AJAX

### SALT BATH FURNACES

Internally heated electric and gas-fired types

**AJAX ELECTRIC COMPANY**  
940 Frankford Avenue Philadelphia 23, Pa.

